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Industrial Heating

ELECTRICITY is often regarded as providing a means of transmitting mechanical power from the prime-mover to the machine to be driven. Compensation for losses incurred in this transmission has to be found in a higher overall economy of centralised power production (allowing for diversity) and in gains due to greater efficiency or convenience in utilisation (including saving in labour) or to an improved product.

A similar comparison may be drawn in the provision of heat, except that here losses entailed in driving the prime-mover would be eliminated if the heat were produced on the spot. What we have called "convenience in utilisation" was well illustrated in an article by Mr. W. Easton, published by us on January 24th, which described a works where the ratio of heating to motive power is unusually high—a criterion advocated by Mr. E. M. Ackery this week.

The particulars there given provide a stimulating example of a prominent firm of electrical manufacturers which takes its own medicine, but they do more. That sentimental considerations do not rule will be clear if we envisage the effect of trying to carry out some of the processes by non-electrical methods.

In a radio factory heating processes are carried out in relatively small units, and considerations of cost of energy may not loom so largely as in a steel works, where the advantages of electricity do not, perhaps, present an immediately obvious economic case unless the cost per kWh is below figures usually quoted. There are also technical obstacles; for example, both tool-hardening and the reheating of steel billets at rolling mills call for temperatures about 1,300 deg. C., but whereas in the former case carborundum resistors do quite well, the metallic elements needed for the larger furnaces are not yet proven.

Yet the merits of resistance furnaces for high-temperature work are such that the development of elements suitable for the operating conditions should, under appropriate tariffs, lead to a considerably extended use of this type of furnace, as shown by Mr. F. Gilberthorpe in his chairman's address to the I.E.E. Sheffield Sub-Centre.

Another outlet for electric heat in industrial processes is found in bright annealing, as this process includes in its merits that of a large saving in space and labour, as discussed in our issue of April 3rd.

In steel melting the value of electricity at present appears largely in the marketing stage, owing to the superior quality of the finished article of both the arc and high-frequency furnace. Nevertheless, Mr. Gilberthorpe has found that some manufacturers still prefer the crucible to the high-frequency furnace for certain kinds of steel, and the reasons for such preference should be investigated. In dealing with such problems the industrial section of E.D.A. is likely to be helpful to the supply engineer.

It can hardly be over-emphasised that to secure the industrial heating load involves much more than cheap electricity. It requires a detailed knowledge of all the conditions under which electricity can be so applied if its claims are to be properly stated.

Not to be Filled

WE believe that there will be general agreement with us in expressing our approval of the decision of the Council of the British Electrical Development Association not to fill the vacancy caused by the resignation of Sir William Ray from the executive chairmanship. We are glad that at last it has been possible to set at rest all doubts on this matter. Speculative anticipation and grand ambition may now seek their objectives in other directions. Since E.D.A. reconstituted itself several years ago, and subsequently strengthened its specialised staff, the position has changed considerably. To-day the organisation stands better equipped for rendering substantial service of various kinds in the development of the supply industry than was the case two or three years ago. This is fortunate, for the work that lies before

it is both heavy and important. Gratifying as may be the present rate of growth of consumers, the vast field of domestic "other uses" beyond mere lighting and wireless will be won largely in the face of fierce competition. This will call for the best propaganda and service that a strong E.D.A. can produce. As was pointed out at the annual meeting, growth of efficiency will bring about the desired increase in membership, and in turn larger membership means more funds for giving still better service. Mr. Robinson mentioned recently that as chairman of the Council he had attended numerous functions in place of the then executive chairman. By so doing he placed the industry under a debt of gratitude, but the need for a strong personal presence representing E.D.A. at numerous public events has not disappeared. Happily, the Association has several gentlemen well qualified to act as official spokesmen on the benefits and prospects of electrical development, and neither Mr. Taite, the chairman of the Council, nor Lord Eltisley, the president, nor Mr. A. C. Cramb, the responsible director and secretary, will fail us in expressing E.D.A. views in an attractive and convincing manner on such occasions. -

Institution Membership

THE membership of the Institution of Electrical Engineers on April 1st was officially given at the annual general meeting yesterday as 16,788—a net increase during the previous twelve months of 638, which is one less than that of the high-water mark of 1930. Full members, however, increased by only three to 1,991, and are therefore a proportionately declining body (in the last membership list, issued in 1933, the 15,025 names included those of 1,945 full members). Losses in this grade there must be, due to the toll taken by time, but it is disappointing to find that the gaps in its ranks, due to this and other causes, were last year only just filled by transfers that amounted to less than one in every hundred of the associate members. There is hope, nevertheless, in the keenness for promotion displayed by the graduates, who have qualified by examination for corporate membership as soon as they have acquired the requisite experience. More than 250 were transferred to associate membership last year; otherwise their grade would have been responsible for nearly 90 per cent. instead of something under one-half of the aggregate increase. In this they were aided by an accession of 352 former students who qualified. It is to the maintenance of this spirit in later life that the profession must look to fill the inevitable vacancies in the senior grade and also to increase the proportion of full members.

Engineering Wages

IN February last the various trade unions of the engineering industry laid a statement before the Engineering and Allied Employers' Federation applying for an advance of three-halfpence per hour to time workers, with an equivalent advance to piece-workers, and the revision of the 1931 agreement on piece-work, nightshift, overtime and coupling-up rates, and reversion to the rates and conditions, including piece-work, in operation prior to June, 1931. The matter was advanced a stage on Wednesday of last week, when the Federation met the Unions in London and Mr. Alexander Ramsay, the director of the former, replied on its behalf. After intimating the existence of a considerable volume of feeling amongst employers that the application was premature, and that more time ought to have been given to absorb the additional wage load of last year before making the present application, Mr. Ramsay reviewed the Union's case, examining the general wages position, the state of the industry, cost of living, export trade and other factors. He then said that the many questions which affected their deliberations were much more suited to a close exchange of views in smaller gatherings. Peace and goodwill in the industry were desired by the Federation and, he believed, by the Unions, too, but they could only be maintained if both sides were reasonably satisfied that justice was being done and that the industry was not being asked to assume liabilities which it could not carry and which would ultimately operate to the disadvantage of both sides. Acting upon this suggestion the meeting appointed a small Joint Committee to examine the situation further and see how far they could arrive at a mutual accommodation of matters between them.

Foreign Electrified Railways

SEVERAL inferences are to be drawn from the discussion at the I.E.E. on Mr. E. R. Kaan's survey of main line electrification throughout the world. The first is that figures of route mileage electrified are not so useful as those that relate to traffic electrified in ton-miles, as the traffic density on the remainder of the system may be too low to justify conversion, although perhaps offering a field for Diesel-electric propulsion. Another point is the present activity abroad in such schemes, which of itself indicates satisfactory experience hitherto, even allowing for the ostensible reason of providing employment by this means that has been given in some countries. Nearer home it was again emphasised that the caution contained in the Weir report that full advantage was not to be obtained by partial electrification of the traffic on any section of line does not mean that it is a case of all or nothing everywhere. This should be clear from the allowance of twenty years for complete conversion.

Static Electricity

IN our comments on January 17th regarding the circular issued by the Ministry of Health as to precautions necessary in operating theatres, we drew attention to the new risks arising out of air conditioning. Static discharge is always a possibility in a warm, dry atmosphere, and, if an ether-oxygen mixture is used as an anæsthetic, an explosion may be caused by quite a small spark. That is apparently what happened at the Middlesex Hospital at the end of last week. The subject is being investigated by the N.P.L., a summary of whose report appears elsewhere in this issue.

Endowment of Research

THE gift by Sir Herbert Austin of £250,000 to Cambridge University for the extension and further endowment of the Cavendish Laboratory is a magnificent tribute to the ultimate value to industry of pure research. The production of very high voltages for carrying out experiments on the transmutation of matter by high-speed particles and by radiation may not yield results of immediately practical utility, but, as we suggested last week in discussing the Kelvin lecture delivered by Dr. J. D. Cockroft (who is himself associated with the Cavendish Laboratory), the final results are not likely to be less far-reaching on that account. Sir Herbert's munificence has a more than national aspect, since the provision of facilities for a scientist like Lord Rutherford to bring to fruition the work of his predecessor, Sir J. J. Thomson, will be a gift to civilisation as a whole.

Enlightenment

To celebrate the attainment of the "five-figure mark" by the combined profits of the municipal tramways and buses, Alderman A. H. Gledhill, the chairman of the Halifax Tramways Committee, entertained the members of his committee to dinner recently. In proposing a vote of thanks to Alderman Gledhill, the Mayor said that he had come to the conclusion that it was a wrong policy in previous years to take profits for the relief of rates. His Worship has arrived at a conclusion which we ourselves reached many years ago, but, all the same, he is to be congratulated on his enlightened views. It is far better to devote profits to the cheapening and improvement of services, whether transport or electricity, than to confiscate them to bolster up general municipal funds.

"Overhead" Distribution

A 10,000-kVA roof sub-station

"SITTING on the load" may be applied to a new 33,000/400-V transformer station at the oil-seed works of Messrs. J. Bibby & Sons, Ltd., Liverpool, in a much more literal sense than is usually associated with the term popular among distribution engineers. For the station is certainly on (above) the load, being situated on the roof of an eleven-storey building which comprises one of the four blocks of the extensive factory as a whole. This new transformer station has two floors, the e.h.p. and l.p. switchgear proper being located on the top floor, while below are installed cubicle isolating switches and the cables interconnecting the station equipment. The only structural alteration required for the main building to accommodate the additional 200 tons weight of the new transformer station was reinforcement of the existing roof so as to distribute the weight evenly over the main stanchions.

The decision that the station should "sit on the load" in the actual sense was the first influence towards this engineering achievement, while its situation at a height of 140 ft. above street level was dictated by the great value of ground and floor space at lower levels. The factory as a whole covers a ground area of about 300,000 sq. ft., including side streets which separate the blocks and also connect Great Howard Street and Waterloo Road which bound the east and west ends of the blocks, respectively.

This shows the 200-ton 10,000-kVA sub-station at the top of the eleven-storey oil-seed works at Liverpool of Messrs. J. Bibby and Sons

Works development trend is to concentrate load at the Waterloo Road end of the factory and particularly in the oil mill block, where public supply is received from the Liverpool undertaking at 33 kV in No. 1 transformer station at the Great Howard Street end. Two 10,000-kVA feeders affording this supply are connected respectively to the duplicate bus-bars of the five-unit e.h.p. switching equipment with vertical isolation and round-tank circuit-breakers. These switches have 400-A and 500,000-kVA carrying and rupturing capacities, respectively, and two of them control interconnectors between the two transformer stations while two others will afford 400-V 3-phase supplies *via* two 2,000-kVA transformers and l.p. switchgear in a scheme similar to that to be described for No. 2 station.

To facilitate the operation and maintenance of e.h.p. cables which in any case would have had to have practically a "drop" of 140 ft., oil-filled cable was adopted for these transformer-station 33-kV interconnectors. Three 0.1 sq. in. single-core cables constitute each interconnector, and the two groups, each in triangular formation, and also a 20-pair pilot cable for remote indications, are laid from the Great Howard Street station underground in the road round the block to a point immediately under the Waterloo Road station to which they then take a direct vertical rise, the groups and pilot cables being separately cleated to the wall inside and the whole encased in sheet steel. Each cable was drawn up the "rise" by a winch, and pending final clamping was lashed to the cleat studs.

Even distribution of the oil in the cables at all loads is maintained by diaphragm-type pressure balancing conservator tanks situated well above the terminal point in the roof station, the necessary communication being provided by small pipes from the conservator to the cable sealing ends. The oil pressure in the terminal boxes at the ground station is 62 lb. per sq. in.

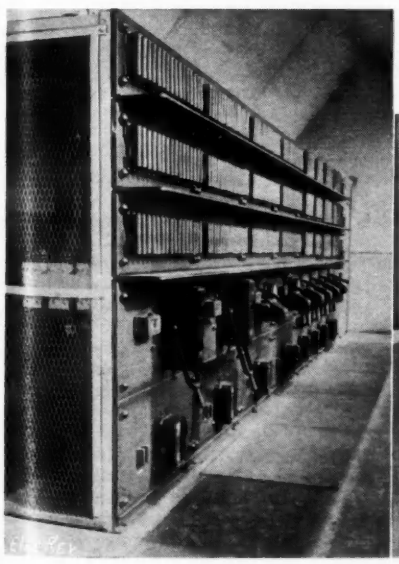
The e.h.p. switchgear in the upper station is similar to that at ground level, and the dual bus-bar system in each case, with transfer circuit-breakers, provides exceptional flexibility in that Bibby's engineers can select at will at No. 1 station either Corporation supply feeder and also either interconnector to and at No. 2 station. Single-core 0.06 sq. in. solid cables provide the e.h.p. connections from the switchgear to the transformers, and they are looped through the cubicle link room below, with roof suspension. Four of the 2,000-kVA transformers are at present installed, and these were crane lifted to the top of the building and lowered into the station through hatchways in the roof.

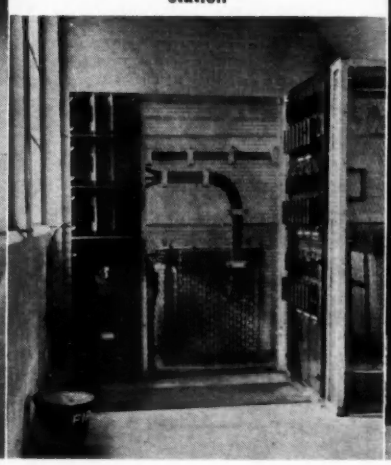
To reduce the maximum lifting weight to 11 tons each transformer was stripped of its radiators, and the equipment was specially constructed to facilitate this. For voltage regulation 2½ per cent. hand-operated tappings to 10 per cent. are provided on the minus side. To prevent any possibility of trouble from building vibration, for instance, cracking at the cable connections, the transformers are braced to the main structure, while cable supports built in the floor are braced to the supporting channels on the transformer tanks.

The transformers each "sit" on a grillage around which is a cast-iron troughing forming a collection sump for oil in the event of a leak. A pipe from each sump communicates with a tank in the room below, and a trap in the pipe, immediately in "front" of the tank, serves as a fire-protection measure, as it will prevent the passage of burning oil.

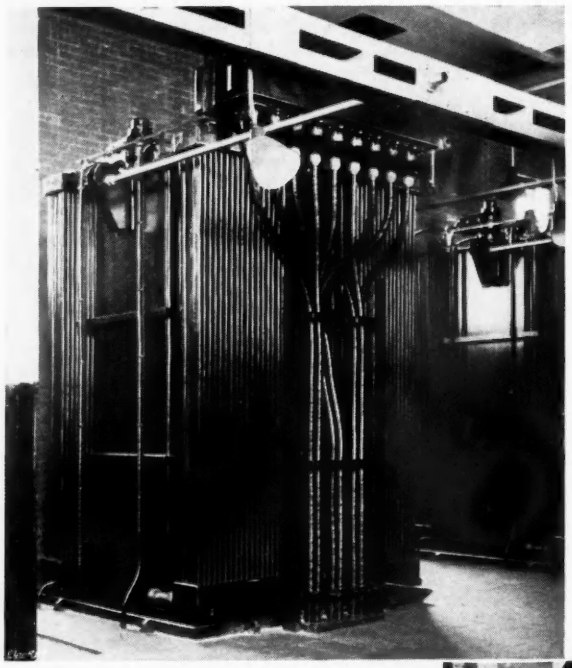
For l.p. distribution there is a sheet-steel cubicle switchboard with duplicate bus-bars and 2,000-A to 3,500-A (50,000-kVA rupturing capacity) circuit-breakers. Hand operation is not a reasonable proposition for such heavy breakers, of course, and the difficulty of closing the breakers in the absence of a d.c. supply has been met by the adoption of the expansion closing method whereby high-pressure gas resulting from electrically heating a special substance actuates the operating mechanism. Closing current is provided by a bell transformer, while a 24-V battery serves the shunt tripping coils, and the two circuits for these operations are controlled by two-way switches (one for each breaker) on a separate control board equipped also with fuses.

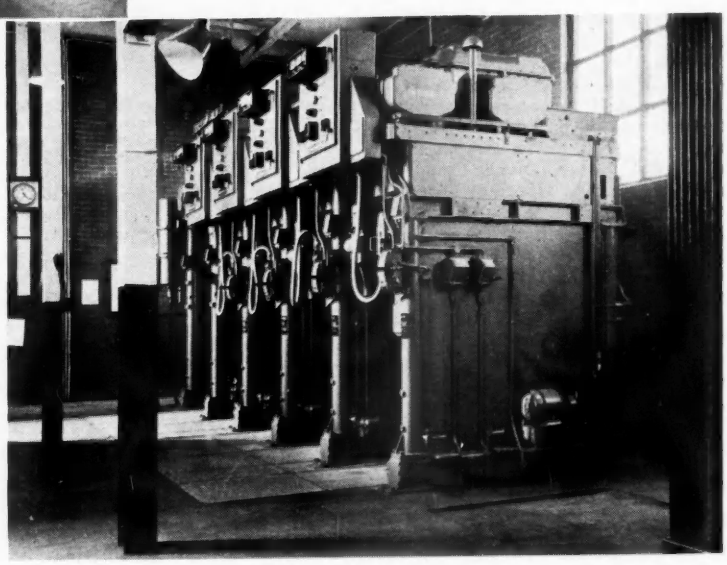
The whole of the 33-kV equipment is protected by overload





Left: A typical l.p. power distribution board. Below: Lighting transformer and switchboard in distribution centre. Right: The end of the 33-kV switchgear in the roof sub-station



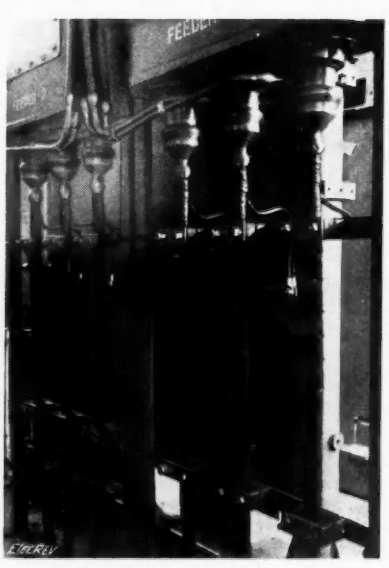


Left: No. 2 sub-station transformers braced to main structure. Right: 33-kV switchgear in No. 2 sub-station, showing diaphragm conservator connected to oil-filled cables

relays which are suitably adjusted to give time discrimination in operation at various points; the transformer l.p. breakers are fitted with relays to give suitable delay in operation, whilst the outgoing l.p. feeder breakers are equipped with relays designed to give instantaneous operation at predetermined settings. For lighting distribution there is a separate switchboard controlled by one of the breakers on the power distribution board.

Heavy copper bars connect the l.p. breakers with the isolating cubicles below, and at the joints they are spring loaded to provide compensation for expansion. At certain points these bars are rather near girders of the station structure, and to prevent undue heating as the result of eddy currents in the girders at each point the girder is fitted with a 4-in. by ¼-in. copper short-circuiting band.

For earthing the No. 2 station a 0.6 sq. in. continuous solid cable directly connects the sub-station with a water ring main around the works. From the main transformer station are supplied fifteen l.p. distribution stations located at load centres about the works. Flat-back switchboards are employed in these centres, each feeder panel being equipped with an isolation and an oil circuit-breaker. Generally power distribution is arranged in groups of motors, each group being controlled by an individual oil circuit-breaker, and the whole scheme is arranged to facilitate metering for costing of the various works departments.



Pipe connections from sealing ends of oil-filled cables

The outgoing distribution panels are each equipped with either 6, 12 or 16 isolating fuse ways varying in size from 60 A to 200 A, each way serving either an individual motor or a group of small motors. For such groups the cables supply double- and triple-tier arrangements of isolation draw-out oil circuit-breakers near the driving points. Where working conditions are suitable circuit-breakers at the motor ends control t.p. distribution boards from which motors in the vicinity are supplied.

All the distribution cables are lead sheathed and armoured, and because of the many vertical rises they are mostly of the drained-paper insulated type finished with non-drip servings. Where convenient, interconnectors between starters and motors are v.i.r. cables in heavy gas piping. Three-core 0.4 cables interconnect the main transformer stations and the distribution centres and at levels which reduce the cable lengths to a minimum these cables cross the dividing streets by means of excellent metal ducting systems termed box girders. In each case an "H" girder spanning the street has between its flanges on either side of the web three or four pipes running continuously from end to end, the whole being clamped rigidly and finally covered in. The pipes thus form suitable draw-ways for the cables.

The factory lighting pressure is 100 V and a local supply is given from each distribution centre from a flat-back board similar to that for the power distribution supplied from a transformer with a single 100-V winding and two primaries connected between two pairs of the phases, respectively. One secondary pole is earthed. While this somewhat unusual scheme of lighting supply is influenced by the initial 100-V system the result is an overall balancing of a phases superior to what it would have been had the standard method been adopted.

A 0.06 sq. in. lighting cable feeding each floor terminates at a d.p. ironclad switch adjacent to a similar fuse board from which v.i.r. cables in heavy-gauge conduit supply the lighting circuits and plug points for portable apparatus separately.

On the average the lighting per floor is about 85 A, and this helps in the cable standardisation scheme. Simplex mill-type lighting fittings are generally employed, but in rooms where conditions are less severe Benjamin, Simplex and "Crosla" reflector fittings are used, while for the laboratories Benjamin "Saflux" fittings, in which the lighting unit proper plugs into a head fixed direct to the ceiling, were chosen. A scheme is being evolved for the installation of discharge lighting in the engineers' workshop where about a dozen 250-W units will serve an area of about 88 ft. by 96 ft. In special houses where mining regulations apply Wigan flameproof fittings are employed with the well glass ring and the head interlocked. Walsall water-type lighting switches and combined switch-plugs of the same make for portable appliances are employed.

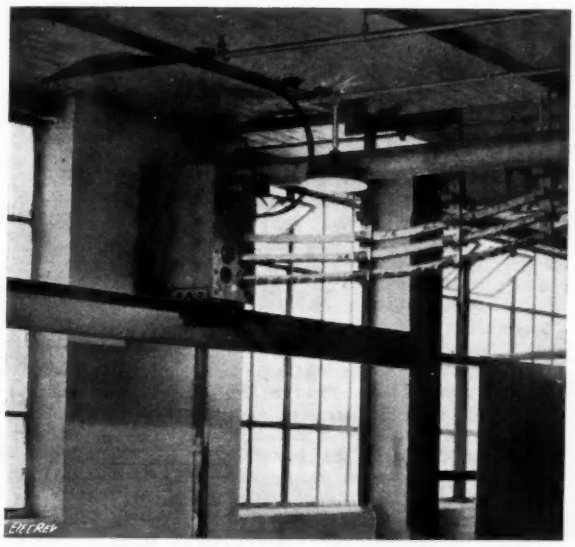
All the cables required in connection with the installation were supplied by British Insulated Cables, Ltd., Pirelli sealing ends being used for oil-pressure cables. The transformers were supplied by Messrs. C. A. Parsons & Co., Ltd., and the whole of the switchgear in the main transforming stations and in the distribution centres was supplied by Messrs. Ferguson, Pailin, Ltd.

The scheme described in this article was designed and installed or supervised by the Electrical Department of Messrs. Bibby & Sons, to whom we are indebted for this information and assistance in taking the various photographs.

Are Kiosks Premises? By a Legal Correspondent

The application of the Electricity Regulations

WITHIN the last few months two corporations have been summoned and fined under the Factory Acts for breaches of the Electricity Regulations following accidents that had occurred at kiosks which formed a part of their distribution systems. In both cases the defence was set up that the kiosks concerned were not subject to the Regulations and therefore the summonses could not apply, but in both the magistrates rejected this plea and imposed a penalty.



End of one of the street crossing box-girder cable ducts (see previous article)

The decisions have raised an important question of principle which many engineers would like to have authoritatively settled, as up to the present it has generally been held that small outdoor kiosks are not subject to the Electricity Regulations. This view has been formed partly as a result of what one might term a general interpretation of the term "premises" to which the Factory Acts apply, but more particularly owing to the explanatory comments contained in the memorandum on the Regulations issued by the Senior Electrical Inspector of Factories.

The subject is important enough to merit careful consideration. It may be noticed in the first place that the Electricity Regulations were framed by the Secretary of State under Section 79 of the Factory and Workshop Act, 1901, and they apply to electrical stations which are defined in that Act as

> "any premises or that part of any premises in which electrical energy is generated or transformed for the purpose of supply by way of trade or for the lighting of any street, public places or public building or of any hotel or of any railway, mine or other industrial undertaking."

It is obvious from this definition that the Regulations only apply provided two conditions are fulfilled: (1) There must be a premises or part of a premises; and (2) the premises must be used for the generating or transforming of electrical energy for the purpose of supply by way of trade, etc. In applying this definition to a kiosk the first point to be decided is whether a kiosk is in fact a premises or part of a premises. The Senior Electrical Inspector in his memorandum on the Regulations (Form 928) apparently takes the view that a kiosk is not a premises within the meaning of the Act, unless it is a sub-station. He states:—"As the Regulations do not extend to premises which are not under the Factory Acts they do not apply to street mains or transmission lines or to transforming pits, boxes or kiosks other than sub-stations."

Whether or not a kiosk is a sub-station is determined by the definition given in the Regulations, viz:—

> "Sub-station means any premises, or that part of any premises, in which electrical energy is transformed or converted to or from pressure above medium pressure, except for the purpose of working instruments, relays, or similar auxiliary apparatus; if such premises or part of premises are large enough for a person to enter after the apparatus is in position."

A kiosk will therefore not be a sub-station, notwithstanding the fact that it may be used for transforming electrical energy, unless it is large enough for a person to enter after the apparatus is in position. One would conclude from the above that generally speaking small transformer kiosks are not covered by the Regulations, and this is undoubtedly the view held by most electricity supply engineers.

Neither of the kiosks at which the accidents happened was more than about five feet square and seven feet in height, and with the apparatus in position, which included a transformer, switchgear, links, etc., it was impossible for a person to enter. It was reasonable to assume, therefore, that these kiosks were of a type which the Senior Electrical Inspector had in mind when he stated that the Regulations did not apply to kiosks other than sub-stations. This seems to be supported by other language used by the Senior Inspector, as he states that "the limitation in the last two lines of the definition of 'sub-station' excludes transforming pits or boxes which are not large enough for a person to enter. Such pits or boxes are subject to the Regulations only if they are on premises which are independently factories or workshops." In neither of the above cases was the kiosk situated in a factory or workshop, both being erected in the open.

The only possible ground upon which it might be argued that these small kiosks came within the Regulations is that the words "large enough for a person to enter" are intended to cover the entry not only of the person as a whole but of part of his body. One would presume, of course, that the reasonable and ordinary meaning of the words is that the

L.p. switchboard in No. 2 sub-station, including expansion closing circuit-breakers (see previous article)

kiosk must be large enough for the person as a whole to enter and not that there should be sufficient space to allow of the entry merely of an arm, a leg or a finger. If, however, the term "person" is to be taken as meaning part of a person, including for instance a finger, it would seem to be stretching the words beyond their reasonable meaning and rendering the whole phrase pointless, as it is inconceivable for a kiosk to be constructed at all without the possibility of a person being able to insert a finger in it.

One is also entitled to look at the Factory Acts as a whole. They were primarily designed to protect people actually working in premises such as factories and workshops. If a person cannot, in fact, enter a premises obviously he cannot work in it and therefore a structure such as a kiosk which is too small for a person to enter can hardly be regarded as a premises within the meaning of the Acts. To adopt any other interpretation would be to extend the signification of the word unduly and beyond what is warranted.

During the hearing of one of the summonses, the prosecution advanced the argument that the accident arose on a switchboard in the kiosk and that switchboards are covered by the Regulations. On the face of it the reasoning is surely fallacious. A switchboard by itself does not and cannot constitute an electrical station, it must be on a premises. If it is not on a premises to which the Factory and Workshops Act applies the switchboard itself will not be covered by the Regulations.

The above discussion has been confined to the legal issues involved and is not intended to advocate the non-application or otherwise of the Regulations to a particular structure. It may, in fact, be desirable that the Regulations should apply even to the smallest kiosks, but that is not the point at the moment. What is being argued here is that the dubiety which at present exists should be cleared up. The decisions of magistrates are not to be taken as authoritative from the legal

point of view and the position can only be clarified when some corporation after being penalised has the temerity to take the matter on a stated case to the Divisional Court. If the Court upholds the view of the Bench that will settle the question and engineers will know where they stand, but in that event the memorandum of the Senior Electrical Inspector ought to be modified so as to remove the ambiguity now existing.

Apart, however, from any judicial decision it would seem to be desirable for the memorandum of the Senior Electrical Inspector of Factories to be reviewed. It must strike anyone as inconsistent on the part of the Home Office to lead engineers to believe that certain kiosks are excluded from the provisions of the Electricity Regulations and then when an accident occurs to prosecute them.

The Work of the N.P.L.

Results of electrical researches

THE annual report of the National Physical Laboratory for 1935 (H.M. Stationery Office, 12s. net), shows that there were substantially more demands for assistance from industry during the year, particularly from the shipbuilding industry. Increased activities were recorded in the Sound Division and the Physics and Engineering Departments, while the Radio Department was invited by the Air Ministry to undertake an extensive investigation into radio methods for the guidance of civil aircraft. The photometry building was completed and additions to the new Acoustics Department were commenced.

Television developments have created a demand for insulating materials to be used at very high frequencies. Accordingly, the Electricity Department has constructed new apparatus for dielectric measurements with a frequency range of from 10^4 to 10^8 cycles per sec., and power-factors may be measured to 0.0001 over the whole range. The sample to be tested is placed between a pair of electrodes, the separation of which is controlled by a micrometer adjustment. The test condenser so formed is connected in parallel with a tuning coil, a thermionic voltmeter, and a micrometer condenser of low range, which provides a fine adjustment. This circuit is coupled to an oscillator and resonance is established. The width of the resonance curve observed by means of the micrometer condenser and thermionic voltmeter is proportional to the total power loss in the circuit, and thus, by making measurements before and after inserting a sample of dielectric, the power factor of the sample may be deduced. A great advantage of the method is that the readings corresponding to a given power-factor are the same whatever the frequency.

Improvements which have been made in the cathode-ray oscillograph installed in the high-voltage laboratory include the substitution of metal for glass discharge tubes, improvement in the trapping of the electron beam, and the provision of pre-anode focusing. The first makes for a smoother discharge; the second enables the oscillograph to be run for long periods without appreciable fogging of the record by stray untrapped electrons; and the third increases considerably the ratio of "writing" electrons to total electrons emitted by the cathode. A record can now be obtained of the breakdown of a spark gap 0.05 microsecond after the application of the voltage wave to the gap.

Work done for the British Electrical and Allied Industries Research Association during the past year included an investigation of the performance of insulators under transient electrical stresses, the breakdown characteristics of insulating materials under such stresses, and a study of the operating characteristics of typical lightning protective devices.

Static Electricity Investigations

An investigation has been undertaken by the laboratory on the production of static electricity in operating theatres of hospitals. Some of the anæsthetics in common use are of an explosive character, and the possibility of the production of electrostatic charges and the risk of their ignition by sparking is one which cannot be neglected. Similarly, for the Home Office a preliminary examination has been undertaken of the risk of ignition by sparks due to static electrification in dry cleaning works.

The rate at which the eye recovers its sensitivity to small contrasts after it has been exposed to a glaring source of light has been investigated and eight street lighting installations have been measured to determine the illumination over the carriageway.

At the request of the Government of Northern Ireland experiments have been carried out on the practicability of installing an electric barrage in connection with an important eel fishery. The object is to guide the eels into the part of the river where the traps are installed by electrifying the water where it is desired to prevent them from passing. Quite a low voltage is sufficient to act as a barrage, and on account of the high resistance of river water the power required is small.

New instruments for metallurgical research have been devised in the Metallurgy Department. A motor-driven potentiometer greatly simplifies the taking of thermal curves. It is so designed that all measurements of the e.m.f. of the thermocouple are made with the galvanometer undeflected, so eliminating instrument errors. The instrument is completely automatic, being set in action by a photo-cell each time the galvanometer spot crosses the zero. It is normally used with the Rosenhain plotting chronograph, and then traces thermal curves without the use of tapping keys.

Another apparatus provides means for raising or lowering the temperature of a furnace in a linear manner. A moving potential divider provides a steadily increasing or decreasing e.m.f., which is opposed to a thermocouple inserted in the furnace. The resulting small current deflects a mirror galvanometer, which operates a photo-cell, this in its turn regulating the heating current through a thyratron and a small motor.

Conductivity of Metals

From tests in the Physics Department on the thermal and electrical conductivity of metals at high temperatures it appears that a very fair estimate of the thermal conductivity of a steel can be made from a knowledge of its electrical resistivity at high temperatures, though not at low temperatures. The general accuracy obtainable in optical pyrometry is now limited only by the sensitivity of the eye, and attention is being devoted to the development of an instrument in which the eye is replaced by a photoelectric cell.

In the somewhat lower temperature range for which the International Temperature Scale prescribes thermocouples as the interpolation instruments, an increase in the precautions for securing constancy and uniformity of temperature in the specimen has raised the reproducibility attainable at the melting point of silver (960 deg. C.) to 0.01 deg. C.

X-ray examination of the structure of electroplated metals shows that the diamond hardness number is definitely correlated with the breadth of the diffraction lines, and therefore either with lattice distortion or with the presence of crystallites of dimensions of the order of 10^{-5} cm. As regards the orientation of the crystals, it is found that natural lustre is associated with a high degree of parallelism, and a dull surface with random orientation.

The measurement of quantities of radium is normally carried out by its gamma-ray activity, and a valve amplifier has now been applied to this purpose, with a considerable saving of time as compared with the measurement by means of a gold-leaf electroscope. It has been found that if the protection afforded by a building material is deduced from the assumption that the mass absorption co-efficient is the same as for lead, it may be overestimated by as much as 50 per cent.

In the Radio Department the propagation of wireless waves has been investigated by projecting signals vertically and studying echo reception; signals received from distant transmitters are now being likewise studied. For sounding the ionosphere at vertical incidence, photographic reception records are obtained from which the height of the reflecting layer and its reflecting properties (density of ionisation) may be deduced. At least three fairly well defined regions have been detected in the atmosphere, whose reflecting powers are generally greater in summer than in winter, but this factor depends largely on the wave-length used.

In the Aerodynamics Department it is now possible to see air flowing over the surfaces of the wings of a model aeroplane suspended in a wind tunnel, through which air is blown by a motor-driven fan. The method consists in photographing the shadows of small spots of hot air moving with the air current. The hot spots are produced by tiny electric sparks. By using slow motion cinematography their movements can be slowed down so that every detail can be seen.

The N.P.L. 50-acre site at Teddington now accommodates fifteen large buildings with a staff exceeding 600.

I.E.E. Golf Competition

The Mersey and North Wales (Liverpool) Centre of the Institution of Electrical Engineers is holding a golf competition on May 13th at the Royal Liverpool Golf Club, Hoylake, in aid of the I.E.E. Benevolent Fund. Particulars can be obtained from Mr. W. Parry, hon. secretary, 67, Farnworth Street, Liverpool.

Heat in Industry. By E. M. Ackery, B.Sc.

A market for electricity that should be more fully exploited

IN schemes for domestic electrical development the use of electric heat is exploited to the full. Why, then, is industrial heating generally neglected, although the lighting and power loads are eagerly sought after? The only answer seems to be lack of appreciation of the possibilities of electricity as an industrial heating agent. There are few industries that do not use heat at some stage, and wherever heat is employed there is a potential use for electricity. The need is not confined to the well-known industrial areas, as industry is no longer restricted to special localities, but occurs in districts that used to be entirely rural or residential in character. There are electric tar boilers in the heart of the country, electric furnaces in Wimbledon, electric boilers in Bond Street.

Demand for Controlled Heat

Progress in industry has been accompanied by an ever-growing demand for controlled heat; processes for which crude heat was good enough yesterday require controlled heat to-day, and it is in these cases that the opportunity for electricity arises. A cursory inspection of gas journals is sufficient to confirm that the gas industry is looking towards the industrial heating load as an outlet for the therms no longer required for lighting and domestic uses.

Industry is steadily reviving. Many manufacturers are faced with the need for a change from crude heat, obtained by burning coal or oil, to refined heat, but they certainly will not choose electricity unless its merits are constantly pointed out to them. Electric heat must be sold to industry; it will not sell itself. Each job lost to-day may be lost for many years to come.

The industrial power load has not yet reached saturation point, but the cream has been skimmed off the milk and the remaining power loads are increasingly difficult to secure. This considerably strengthens the case for developing the industrial heating load, which has almost unlimited possibilities and offers a relatively easy way of increasing the industrial load.

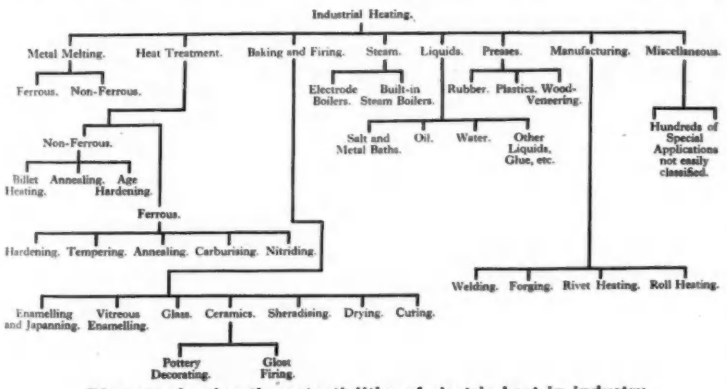


Diagram showing the potentialities of electric heat in industry

The absence of separate returns of the heating load in this country prevents any more than an estimate being made of the present position. The consumption of electricity for power is about 8,000 million kWh per year. The total furnace load is known to be about 150,000 kW with a probable consumption of 450 million kWh per year. Large space-heating loads account for about 200 million kWh, and the consumption from industrial heating other than furnaces can be put at about 300 million kWh, although the latter estimate is very much of a shot in the dark. At the best, however, the industrial heating consumption is only about a tenth of that of power.

Progress in Germany and America

In Germany, it is stated, the electric furnace load in 1934 was 435,000 kW, using 2,600 million kWh per year—equivalent to over 26 per cent. of the total energy sold for industrial purposes. In America ten years ago a survey of 134 typical industrial consumers disclosed that the lighting and power load was 17,500 kW and the heating load 1,500 kW. It was estimated that the heating load that could then be developed economically was 12,500 kW. In ten years equipment has been developed so that the potential heating load to-day probably equals the power and lighting load. There is little doubt that our present industrial heating load is only about 10 per cent. of what it could be.

From the technical standpoint the only heating operations that cannot be carried out by electricity are those at over about 1,200 deg. C., when neither arc nor induction heating can be employed. With these exceptions it is only overall cost that determines whether any particular application is economically possible.

Mr. E. M. Ackery

In general, the factors most favourable to the use of electric heat are:—(1) High temperatures, (2) high value of product in relation to the heating costs, (3) need for extreme accuracy of control, (4) where absolute cleanliness is essential, (5) where the heating process is an isolated one in a manufacturing cycle in which other operations do not require heat, and (6) where, for convenience in manufacture, the heating process must be carried out in the line of production.

The following list of relative power and heating loads is taken from a district that is by no means industrial.

	Light and power. kW.	Heating. kW.		Light and power. kW.	Heating kW.
Telephone cables and wireless ...	1,177	274	Nickel-chromium foundry & works	35	750
Artificial limbs...	109	20	Printing engineers	47	50
Shoes	35	9	Wireless and components ...	29	8
Metal goods	43	248	Electrical manufacturers	9	20
Electric meters...	430	162	Electric-furnace manufacturers	15	74
Lamp works ...	895	260	Aluminium foil .	322	503
Cables	4,219	410	Glass printers ...	17	15
Rolling mills.....	4,876	610	Laminated glass	13	12
Cartridge making	6½	6½	Paper makers ...	23	15
Copper-wire works.....	612	223			
Plastic moulding	9	4			
Sheet-metal works.....	62	50			
				14,200½	3,732½

Here the heating load is roughly 28 per cent. of the power and lighting loads from industry, a result that is extremely creditable but unusual. Manufacturers in general do not seem to be aware of the scope for electricity as a heating medium, and electrical manufacturers are no exception. To take a typical example, vitreous enamel finishes for electrical apparatus are becoming more popular year by year, but only a small proportion is enamelled in electric furnaces. Electrical manufacturers may complain that the supply industry will not give sufficiently attractive rates, but they could do a great deal more in popularising the use of electric heating by setting a good example. A few have taken this course, one such being Ferranti's radio works where electric heat is used for every possible application and where the connected heating load is 723 kW and the power and lighting load is 1,177 kW.

Building-up the Load

The American survey already referred to disclosed that a large proportion of the potential heating load consisted of small miscellaneous applications of a few kW each. This shows that there is an excellent opportunity of getting in the thin edge of the wedge by the installation of apparatus that is cheap in first cost and can be easily installed.

Ignorance of the possibilities of electric heat must be tackled by energetic publicity and no opportunity of putting forward the case for electricity should be neglected whether it be by personal contact, articles in the technical Press, or by lectures to engineering and industrial societies.

Finally, a spirit of friendly rivalry between supply authorities should be encouraged. This attitude has done much to help on the development of domestic cooking and water heating. Why should not supply authorities publish lists of the ratio of industrial heating and power loads in their areas or particulars of the extent of heating development in various industries. Will anyone come forward with a better list than that given in this article?

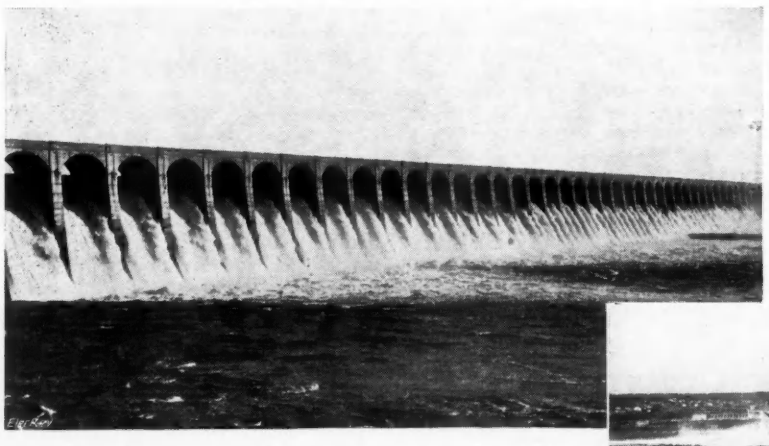
A start could well be made by power sales engineers getting hold of the E.D.A. series of electric-heat booklets, making a list of the applications of electric heat which are admittedly commercially established and then putting down the number of installations of each kind in operation in their areas, together with the number that is yet to be connected. Such information would go a long way towards making up for the lack of a national census of industrial electric heating. Why not a campaign for a million kWh of industrial heating load?

The Tennessee Valley Scheme. By H. E. M. Kensit

The general improvement of the great area

ALTHOUGH the scheme undertaken by the Tennessee Valley Authority is not so great, with regard to the electric power side, as the British grid system, its scope is not confined only to the production of electricity. The special interest of the T.V.A.'s scheme lies in the fact that, by the aid of parallel and equally important measures, it aims not only at the improvement of the electrical service but at the complete rehabilitation of industry and agriculture in a large area that has abundant resources and yet has been lagging behind. It is certainly a study in complete planning, and the Government's intention is to use it as a demonstration and "yard-stick" of what could be done in other similar areas of the United States. It has been termed "a sociological experiment conducted on a scale unparalleled outside Russia."

The plans formed and undertaken by the T.V.A., which was constituted by the United States Government as one of the "administrative activities to aid recovery," were authorised by the Act of Congress approved on May 18th, 1933, and subsequent additions up to August, 1935. They embrace flood control, improved navigation to create a waterway system, reforestation, development of mineral and industrial resources, and extensive distribution of electricity, all with the object of promoting "the general social and economic well-being of the Valley," this being an area about four-fifths the size of all England.



The Nature of the Area

The district embraces the entire watershed of the Tennessee River, which is mainly in Tennessee, but includes portions of several States. The total area is 42,000 sq. miles and contains over 2,000,000 people with four million more in the directly tributary districts. Within this area there is raised everything that can be grown from Canada to Louisiana, including tobacco and cotton, and the mineral production includes coal, iron, phosphate, petroleum, marble and pyrites. The elevation ranges from 6,000 to 250 feet and the rainfall from 50 to 80 inches per annum.

The area, once prosperous, has been going backwards for a number of years, mainly from extensive soil erosion, which forms the most pressing problem. Forest lands originally covered some 30,000 sq. miles out of the 42,000, but there are in Tennessee proper nearly 250,000 farms totalling 18,000,000 acres. A large part of the forest area on the rolling uplands has been denuded and farmed, and every year millions of tons of fertile top-soil are swept away by the heavy rainfall. It is stated that large numbers of once well-to-do farmers have been thus reduced to penury. One of the most important parts of the T.V.A. programme is to reduce this erosion by reforestation, by the creation of strong pastures and by the building of numerous storage dams on the tributaries of the Tennessee River to control the floods, and to restore the fertility of the soil by the production of fertilisers by means of the power developed on the main river and its branches.

An idea of the comprehensiveness of the scheme may be obtained from the following list of the more important subsidiary organisations that have been formed:—

The Tennessee Valley Associated Co-operatives to organise and finance industrial enterprises.

The Electric Farm and Home Authority to assist in financing consumers to purchase both domestic appliances and farm machinery.

The Rural Electrification Administration to finance electricity supply in rural areas. This will, under suitable conditions, lend the entire cost of new lines in areas without electric service. It is expected to supply 350,000 farm families.

Resettlement Administration to finance the removal and resettlement of destitute or low income families on better lands.

Emergency Conservation Work to organise public works to provide employment by restoring depleted natural resources.

These organisations are all working towards the declared objective of making the production, both agricultural and industrial, ten times as great as it now is. The appropriations have been over £75,000,000, of which nearly 45 per cent. is for electric power, but these are understood to be by no means final.

Engineering Features

The engineering features cover dams and other works for flood control, storage and navigation and the generation and distribution of the electric power that will be created thereby. The undertakings are numerous, as there may be as many as twenty dams, and only the principal features can be mentioned. The Tennessee River rises in Virginia, crosses the State of Tennessee twice and flows 950 miles to the Ohio River near its junction with the Mississippi.

Starting at the headwaters, the first important work is the Norris Dam on the tributary Clinch River, 1,800 ft. long and 265 ft. high, creating a reservoir of 83 sq. miles that will store nearly a year's rainfall at this point; it is due to be completed this year, and the plant will contain two 66,000-h.p. units. Another large dam will be constructed on the French Broad River, another of the head-water tributaries. On the main river there comes next the Hales Bar Dam already constructed and privately owned by a power company. Next comes the Wheeler Dam, to be finished during this year, more than a mile long and 70 ft. high; the generating plant will have an ultimate capacity of 376,000 h.p.

The Wilson Dam shown above is nearly a mile long and over 100 ft. high. At present the plant has a capacity of 261,500 h.p., but this will be increased ultimately to 613,000 h.p.

The Wilson Dam which follows is already constructed and is owned by the Government. This is the famous Muscle Shoals plant built during the Great War to produce nitrates, but that portion of the plant is now obsolete. For years this plant stood almost idle, but has now been taken over by T.V.A., which is distributing power therefrom. It is nearly a mile long and 107 ft. high, and has 261,500 h.p. installed and an ultimate capacity of 613,000 h.p. This plant is what is called a "run-of-the-river" plant, that is, it has no storage and the capacity of the river flow varies from 300,000 to 50,000 h.p. It will be now used in conjunction with the above-mentioned Norris Dam plant, two hundred miles up-stream. When water is plentiful the Norris plant will be shut down and water accumulated, but when water is low the Norris plant will operate and the same water will be used again at the Wilson Dam. It is estimated that the two plants so operated will give five or six times as much power as either one could separately.

Fifty-three miles down-stream from the Wilson Dam will be the Pickwick Dam, nearly a mile and a half long and 103 ft. high, and this will back up the waters the whole way to the Wilson Dam. No power station will be built at this point until the demand justifies it. At this dam there will be installed a navigation lock 600 by 110 ft. with a lift of 61 ft.,

which is claimed to be the greatest single lift in the world. As before stated, there will be a number of additional dams on the tributary rivers to conserve the waters further, and it is estimated that a total of three million kilowatts of hydro-electric power could be developed in the Tennessee watershed. With the lock at the Pickwick Dam there will be made available a 7 to 9 ft. navigation channel along the Tennessee River from the Ohio River to Guntersville, Alabama, a distance of 558 miles.

As before mentioned, a leading part of the T.V.A. plan is to provide quantities of better and cheaper fertilisers. Of the two plants at Muscle Shoals, No. 1 is now obsolete for nitrate production and is being used to produce power for general distribution. No. 2 plant, employing the cyanide process, is more modern; it is being kept in condition for national defence and also being extended, mainly for producing fertiliser from the extensive phosphate deposits in Tennessee and also from combinations of potash, nitrogen and lime.

All surplus power in excess of the Government's needs will be made available first to local authorities and then to companies and individuals at the lowest possible rates after providing fully for taxes, interest, depreciation and retirement of investment. It is of interest to note that these allowances are to be 5 per cent. of gross sales to be paid to the State in which the T.V.A. power is generated, as a compensation for loss of tax revenue; 7½ per cent. for taxes; and 3½ per cent. for interest on investment, this allowing a margin for gradual repayment of principal.

Long-service Electric Vehicles

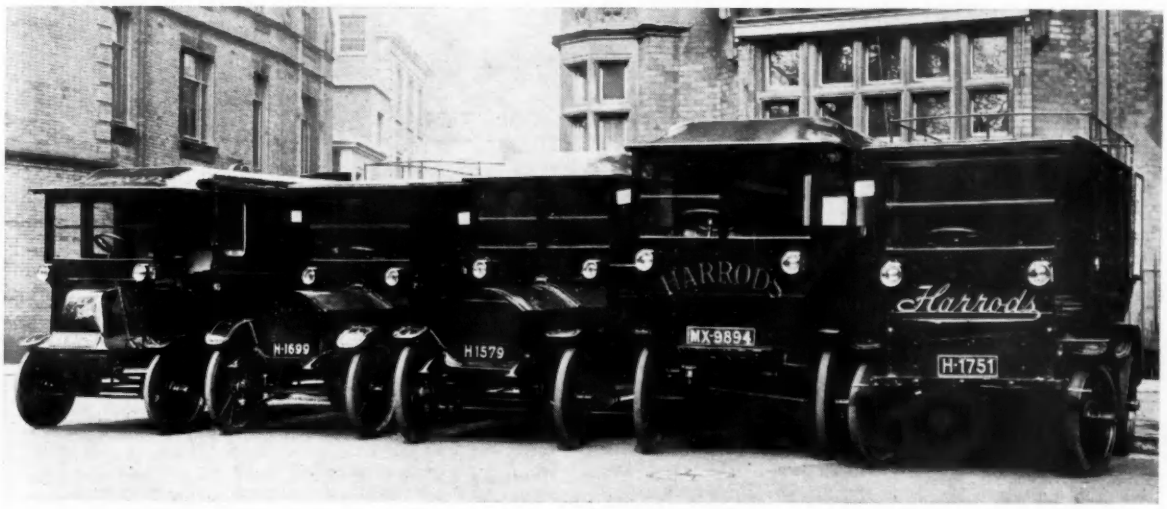
Still in daily use

"YOU know what is wrong with them, don't you? They won't wear out." That was the "criticism" of Mr. J. D. Spark, the Willesden borough electrical engineer and manager, when we asked him for information regarding the life and performance of the electric vehicle, and it seems in agreement with the experience of others who have employed this means of transport for many years. Occasionally it may become necessary or desirable to fit an up-to-date body, but the original chassis and operating mechanism still continues to function reliably and economically. Our investigations show indisputably that, provided the vehicles are used for the particular purposes for which they are suited, *viz.*, short-distance delivery or collecting work necessitating frequent stops, they have no rivals in efficiency and economy, not to mention their silence and hygienic qualities.

Practically all the older electric vehicles in use to-day are of over one-ton capacity, the smaller types having become popular only during recent years. Out of a total of 631 electric vehicles registered for the first time last year, only 78 were models of over one-ton capacity.

One of the most extensive uses of the electric vehicle is for the collection of house refuse. Willesden has had a fleet of fourteen Ransomes, Sims & Jefferies' "Orwell" 50-cwt. vehicles in constant service for over fifteen years, and Mr. A. W. Blake, the late borough electrical engineer, stated shortly before he died that their efficiency and useful life was about four times that of petrol vehicles doing the same work, and that the working time lost due to breakdowns tended to become less as the vehicles grew older.

A more comprehensive idea of the qualities of the Willesden vans may be obtained from a perusal of the table published below. It will be noticed that the totals under the heading



None of these vehicles of Messrs. Harrods, Ltd., was purchased after 1918 and some of them have been in daily service since before the war

Fourteen Willesden Electric Vehicles for Refuse Collection

STATISTICS for year ended March 31st	1921.	1922.	1923.	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.	1932.	1933.	1934.	1935.
Number of vehicle days	4,146	4,242	4,270	4,214	4,284	4,298	4,298	4,180	4,259	4,304	4,287	4,270	4,272	4,217	4,286
Total miles run	52,433	56,641	56,208	56,032	55,871	55,033	52,519	51,488	53,263	52,431	53,035	56,441	54,973	53,274	55,560
Average miles per day	12.3	13.35	13.16	13.3	13.04	12.57	12.219	12.32	12.51	12.18	12.57	13.2	12.868	12.68	12.9
kWh to motor generator	90,913	89,830	107,514	117,092	118,178	122,033	98,037	102,002	128,025	125,675	132,374	117,712	107,079	99,375	108,897
kWh per ton collected	3.4	3.3	3.5	3.8	3.7	3.9	3.25	3.4	3.9	3.9	4.3	3.8	3.7	3.1	3.9
Average motor generator kWh per mile	1.73	1.586	1.912	2.09	2.194	2.301	1.961	1.951	2.4	2.4	2.4	2.08	1.9	1.9	1.9
Average vehicle kWh used per mile	1.25	1.21	1.22	1.293	1.518	1.594	1.6	1.581	1.576	1.603	1.599	1.56	1.57	1.52	1.349
Average tons collected per day per van	6.27	6.35	7.12	7.176	7.288	7.218	7.009	7.08	7.54	7.38	7.13	7.14	6.51	7.37	6.39
Cost of repairs	£329	767	1,254	1,996	670	1,473	1,168	622	1,571	2,091	1,092	979	963	1,247	1,053
Drivers' licences and registration	£22.5	87.25	89	90	89	88	152	341	340	339	341	340	340	419	729
Insurances	£80.5	76	78	75	77	76	76	75	77	76	81	76	76	73	72
Depreciation	£1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	41	37	33	30	27
Aggregate hours lost by all vehicles	99.75	51.3	32.00	37.25	47.5	40.5	46.25	51.30	51.75	24.25	37.5	41.75	23.0	13.5	37
Percentage of time lost to total working hours	0.3	0.15	0.095	0.106	0.136	0.115	0.13	0.15	0.146	0.06	0.107	0.119	0.06	0.04	0.109
CAUSES OF TIME LOST.	Hr.	Hr.	Hr.	Hr.	Hr.	Hr.	Hr.	Hr	Hr.	Hr.	Hr.	Hr.	Hr.	Hr.	Hr.
Batteries	7	3	0¾	2¾	8½	1¾	0½	2½	2	2	—	—	—	—	—
Brakes and spindles	—	20	0¾	—	—	—	—	—	5	5½	4¾	4½	1	—	1
Electrical connections	2	6	10½	8¾	9½	11	13	1½	11¾	13½	17½	17	14½	4	13
Motors and driving pinions	86¾	18	4¾	12½	26	22¾	32½	34¾	29	1½	7¾	16½	5¾	1½	2½
Broken springs	4	—	4	1½	4	3½	0½	5¾	1½	—	2	0½	—	0½	—
Collision and accidents	—	—	8½	—	—	—	—	4½	—	—	—	—	—	5½	—
Other causes	—	4¼	2¾	12	—	1½	—	2½	2¼	2	5½	3½	1¾	2	20½
	99¾	51½	32	37½	47½	40½	46½	51½	51¾	24½	37½	41¾	23	13½	37

"Repairs" show a considerable increase for the years 1929 and 1930, this being occasioned by the fitting of new bodies which increased the capacity by nearly 50 per cent., and since then new floors have been fitted. The bodies, which are painted every two or three years, are now said to be good for at least another five or six years. It speaks well for the modern lead battery that during the last five years not a single hour has been lost through failure of this component, the guaranteed life of which is three years.

In addition to those in service for refuse collection the Willesden Corporation has three vehicles for the use of the Electricity Department, namely, a 50-cwt. van for the Mains Department, an electric tower wagon for the maintenance of

How an eighteen-year-old Walker van has recently been modernised by Messrs. Hovis, Ltd.

the street lamps, and a Wingrove & Rogers "Victor" (15-cwt.) delivery van. The attractive rate of 0.45d. per kWh now offered by the Electricity Department for charging the vehicles is likely to induce many private concerns to adopt this means of transport for short-distance delivery work.

The honour of possessing the oldest large fleet of electric vehicles probably goes to Messrs. Harrods, of Knightsbridge, none of whose well-known green vans is of later date than 1918. In fact, some of the original vehicles purchased in 1913 are still in daily use and giving as good service now as they did then. Each of the sixty-six vehicles (most of which are Walker one-ton models) has done well over 100,000 miles with scarcely any time off the road, and Mr. W. Howes, the company's chief engineer, attributes their satisfactory operation and longevity to having specially trained men to look after them. He does not approve of automatic charging of the batteries, and by giving each vehicle individual attention he is able to claim a life of at least ten years for the Edison nickel-iron batteries used.

The life of the Harrods' vans is all the more remarkable on account of the frequent overloading necessary. In 1935, for the 382,359 miles run 315,127 kWh of electricity was required

A Ransomes, Sims & Jefferies' refuse-collection vehicle which has been in constant use for over fifteen years. The doors at the back are a recent improvement

for charging purposes, and with electricity at ½d. per kWh the operating costs per mile, excluding driving, porterage, insurance, taxation, and depreciation, but including maintenance, tyres, repairs, battery and charging attendance, amounted to 3.425d. Their average speed of about 12 m.p.h. is, of course, rather lower than that of the modern vehicles, but they still have a range of 40-50 miles per charge and look fit for another twenty years' service.

Nearly twenty years' continuous service can also be claimed for a number of vehicles owned by Messrs. Hovis, Ltd., whose transport manager, Capt. C. F. Roberts, speaks very enthusiastically of them. One of their principal advantages, he says, is their capacity for being available for work on more days than any other type of vehicle. In fact, a six-years' comparison between electric and petrol vehicles performing the same duties showed that the former had almost exactly 50 per cent. fewer days off the road. Other points in its favour are that its tyre mileage is three to four times that of all other vehicles carrying the same weight; it cannot be overdriven; it does not waste fuel when standing yet has excellent acceleration; and it provides a useful off-peak load for the power station.

Capt. Roberts is also one of those people who has come to the conclusion that electric vehicles do not wear out, and he has gone to a lot of trouble in devising methods by which they may be adapted to meet modern requirements. As an example, the Walker van illustrated, already about three times the age of most petrol vehicles, has just been fitted with pneumatic tyres and a new Young battery (claimed to be the largest traction set in use on a commercial vehicle in this country) which gives it a range of 55 miles on one charge. The redesign of the drive and a reduction of the gear ratio has increased its speed by 7½ per cent., while licensing charges are reduced by £11.

Capt. Roberts considers that the modern practice of utilising rectifiers for charging the batteries should do a lot towards popularising the electric vehicle, for with one rectifier per vehicle there is now no necessity to provide expensive charging equipment with a view to possible expansion in the future. His experience shows that, although the life of the lead battery is about two and a half years and that of the nickel iron about eight or nine years, they will not retain their full capacity over the whole of these periods, their life, in fact, being dependent on the care taken in charging and maintenance.

Lead batteries use less electricity for charging, require less maintenance, and have a lower internal resistance than the nickel iron variety, which, however, will stand more overcharging and need less attention. In this connection it is of interest to note that battery manufacturers are nowadays willing to enter into hire-maintenance agreements under which they undertake to maintain the batteries up to a specified capacity for a period of years, including periodical inspection by their engineers, and such maintenance work as will ensure to the user the most satisfactory service.

Messrs. Hovis have recently acquired over seventy small vans (mostly Morrison and Wilson) for hiring out to bakers.

Radio Research in Australia

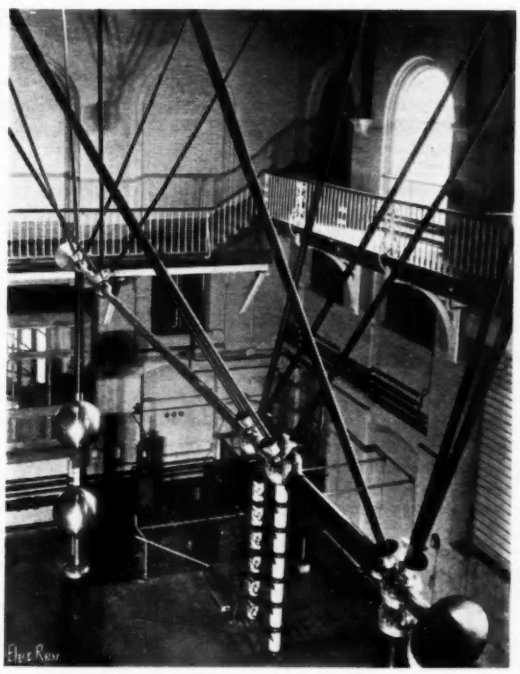
Report No. 9 of the Radio Research Board of Australia (C.8280, H. J. Green, Government printer, Melbourne) contains seven papers. The first is a study of the magneto-ionic theory of wave propagation by means of conformal representation, while the second contains dispersion and absorption curves for radio wave propagation in the ionosphere according to the magneto-ionic theory. The third describes a temperature compensated dynatron oscillator of great frequency stability, and the fourth deals with the amplification of programme transients in radio receivers. The fifth describes a multi-range push-pull thermionic voltmeter. The sixth is a graphical solution of simple parallel-timed circuits, and the seventh describes an electrical harmonic analyser of the fundamental suppression type.

Teaching High-voltage Engineering

Powerful new equipment at the Queen Mary College

THE new high-voltage laboratory at Queen Mary College (formerly the East London Technical College) was opened officially on Wednesday of this week by the Earl of Athlone. The purpose of this laboratory is to act as a centre of teaching in high-voltage engineering for the University of London, and also to provide means for research at the College under the guidance of Prof. J. T. MacGregor-Morris, head of the Electrical Engineering Department. Mr. W. J. John, reader in electrical engineering, has co-operated closely with the manufacturers in the design and installation of the new plant, which has been accommodated in the former College theatre, in which an area of 40 ft by 80 ft. by 38 ft. high, has been obtained by removing the old floor.

The equipment is the most powerful of its kind so far installed in a teaching institution and is remarkable also for the inclusion of a d.c. generator capable of an output of 20 mA at 180 kV, with a ripple of six per cent., which can be neglected during insulation tests with a current of the order of one mA. Ceiling bushings, *via* the room above, enable insulators to be tested on the flat roof. The outfit, of "Metrovick" make, employs two thermionic rectifying valves and a two-stage voltage multiplying circuit, chosen because the output can be increased by easy addition of more stages and because it enables the polarity to be changed simply by rearranging the h.v. bus-bars, which swivel in their sockets.



View showing bus-bars sphere gap and impulse generator

Each valve is mounted on top of a filament-heating transformer, with a filament ammeter and voltmeter for each inside the stress distributors on top of the transformers. The latter have specially shielded windings, oil-immersed in synthetic resin-varnished paper cylinders, the need for h.v. bushing being thus obviated.

The secondary winding of the main h.v. input transformer has been vacuum impregnated and is oil-immersed in a steel tank, but the terminal bushing is small as it is required to withstand only about 70 kV (effective) or 100 kV peak. The capacitance of the 100 kV series condenser on top of the transformer is 0.075 μF and that of the main condenser which is located on the floor beside the transformer is 0.037 μF.

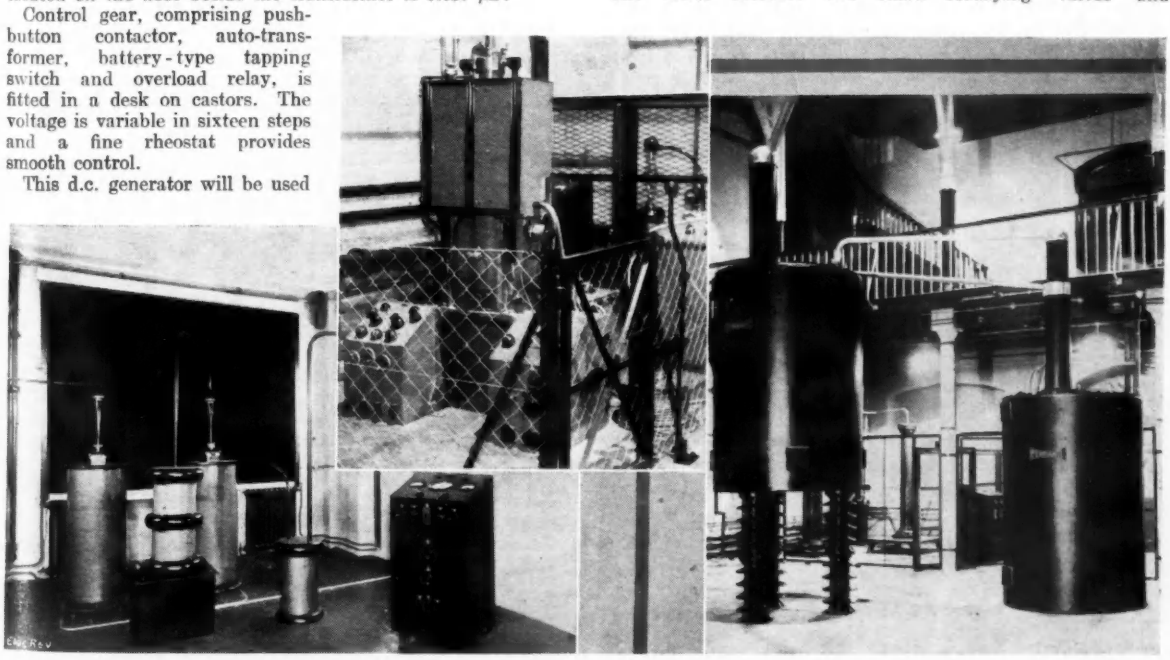
Control gear, comprising push-button contactor, auto-transformer, battery-type tapping switch and overload relay, is fitted in a desk on castors. The voltage is variable in sixteen steps and a fine rheostat provides smooth control.

This d.c. generator will be used to excite the 1,000-kV impulse generator, whose nominal output voltage is one million, the discharge capacitance being 0.003 μF, corresponding to an energy of 1,500 joules. The highest stage voltage is 167 kV, the six-stage condensers and supports forming two vertical columns, connected and stiffened by the resistance tubes. Additional stages can be incorporated without modification. The usual Marx circuit is employed, with an important modification ("Metrovick" patent) whereby the load is earthed through the charging resistances and is not subjected to stress during the charging period. The condensers are oil-impregnated (rated at 167 kV, 0.018 μF) and enclosed in varnished paper cylinders. The end caps and hollow spheres are made of M-V "C" light alloy. All the spark gaps are simultaneously adjustable, the movable sphere in each pair being mounted on a square rod having a vertical rack to engage with a horizontal pinion. The non-inductive wire-wound resistances are of about 100,000 ohms each, so that the wave tail of the output voltage on open circuit is about 600 microseconds.

Essential accessories include a wave-tail controlling resistance, a potential divider resistance, and a series resistance, all non-inductive and of considerable length to withstand momentarily the full voltage of the impulse generator.

The adjacent cathode-ray oscillograph is of the M-V high-speed type specially designed for additional use as an electron diffraction device. The voltage deflection sensitivity is of the order of 500 V per inch and the oscillograph is continuously evacuated. A 50-kV "Osram" rectifier valve provides the "gun" voltage, the timing circuit being of 7 kV.

An M-V Schering bridge has been installed for tests at 100 kV, 50 cycles. Load capacitances can be measured from 3 $\mu\mu$F upward and values of tan d from 0 to 1.111 (d=90 deg. $-\phi$ where cosϕ=power factor). The bridge sensitivity is such that changes in tan d of 0.0001 can be detected with a test voltage of 20 kV and load capacitance of 50 $\mu\mu$F. All leads are carefully screened, the ratio arms being in a table box beside the push-button control desk. The latter includes two small rectifying valves and



Left: The valve generator, supplying d.c. at 180 kV. Centre: Cathode-ray oscillograph. Right: Main cascade transformer

Meetings and Discussions

Radio Condensers
Railway Electrification
I.E.E. Report

Iron and Steel Papers

AMONG the fifteen papers submitted at the annual meeting of the IRON AND STEEL INSTITUTE in London on May 7th and 8th was one in which Mr. G. A. V. RUSSELL discusses some of the considerations that influence the production of steel in wide strip-sheet form under British conditions. The author advances the view that smaller productive units than those established in the United States are desirable in this country, provided that the capital cost can be reduced proportionately, and that substantially the same direct cost is attainable.

The investment represented by a modern American 80-in. continuous rolling mill is stated to be over £2,000,000. As construction costs in the United States are considerably higher than in Great Britain, such an installation would, perhaps, cost £1,700,000 here. The total power consumption for main and auxiliary drives would not average more than 50 kWh per ton, representing a power cost of the order of 1s. 6d. per ton of steel produced.

The tendency in most recent American wide-strip mills to increase the weight per foot of width of the strip rolled has resulted in higher plant costs because, among other items, larger motors are needed for driving the stands of the finishing train, since higher rolling speeds are required. For example, in 1928 the Weirton Steel Co.'s mill with 16 in. by 40 in. by 54 in. rolls needed 11,500 h.p. (2,000 h.p. each for the first and second and 2,500 h.p. for the third, fourth and fifth stands) whereas in 1935 the Ford Motor Co.'s mill with 21 in. by 46 in. by 56 in. rolls needed 14,500 h.p. (3,000 h.p. each for the first to fourth and 2,500 h.p. for the fifth stands).

Mechanical plant is cheaper than electrical. With the typical tandem-continuous layout of all modern American wide-strip mills the individual driving of each roll stand is almost inevitable, and results in an admittedly high investment in main-drive motors, many of which operate with but a poor factor of utilisation. To cut down the number of main roll motors the author suggests a departure from the straight-line continuous disposition in favour of the "cross-country" layout.

The paper outlines three projects as examples of the British conditions adumbrated by the author, each to cater for different requirements, but all designed to roll narrow plates in addition to wide strip. The first project, for producing 175,000 tons per annum, would need one driving motor of 6,000 h.p. (*i.e.*, Ilgner reversing equipment driven by a 3,500-h.p. induction motor) and four others of 2,750 h.p. each. The capital cost would be £513,570, of which £125,920 would represent electrical plant, including main and auxiliary drives, cables, transformers, and sub-station equipment.

The second project is for a capacity of 200,000 tons per annum. It would need one 6,000-h.p. and four 3,500-h.p. driving motors. Of the capital cost of £615,060, £117,130 would be for electrical plant.

The third project contains innovotions in practice (for some of which patent protection is being sought) which the author suggests as likely to be helpful in meeting the requirements peculiar to the British industry. The productive capacity is intended to be 185,000 tons per annum, one 4,000-h.p. and two 3,500-h.p. driving motors being required for the three-stand installation. The total capital cost would be £417,890, of which £74,080 would be for electrical plant. The costs of the electrical equipment for the various schemes considered has been estimated with the help of the English Electric Co., Ltd.

Detinning Tinplate

In another paper Messrs. A. W. HOTHERSALL and W. N. BRADSHAW (Woolwich) describe the results which they have obtained with a new electrolytic method of detinning tinplate without attacking the alloy layer or exposing the steel plate, for enabling the continuity, structure and behaviour on deformation of the alloy layer to be examined, and its thickness to be determined.

The new method consists in anodic treatment in sodium hydroxide solution with the temperature, potential and concentration of alkali suitably controlled.

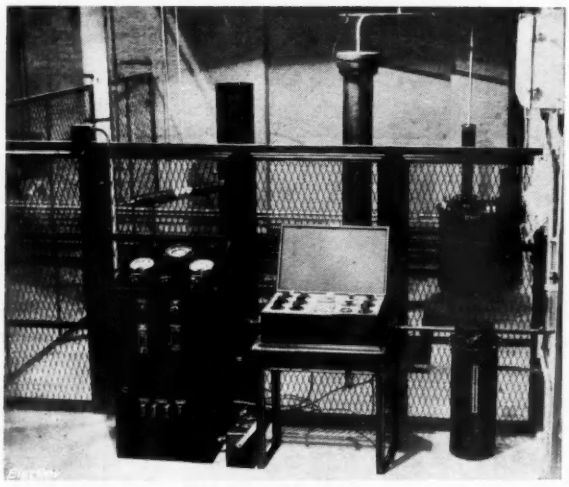
Light's Influence on Corrosion

In a third paper Messrs. C. O. BANNISTER and R. RIGBY (Liverpool University) explain the influence of light on the electrode potential and corrosion phenomena of mild steel. The authors have already demonstrated elsewhere that in the case of zinc and aluminium—metals having but one valency—the influence of light enhances the effect of aeration and renders the illuminated electrode cathodic, or increases the e.m.f. in this same direction. In the case of copper, a metal possessing two valencies, the differences of e.m.f. between the illuminated and the non-illuminated electrodes are more complex and vary with the rate of supply of oxygen and other factors. The variation in the proportions of cuprous to cupric oxides present on the electrode also plays an important part in the reactions, and in the direction of the e.m.f.

The metal iron reacts to some extent in the same manner as copper, for in addition to the action of the electrolyte and of oxygen on the metal, there is the influence of the equilibrium between the ferrous and ferric ions in the electrolyte to be taken into account; these factors include the conversion of

Teaching High-voltage Engineering (*Continued from preceding page*)

a d.c. milliammeter to enable the charging current of the terminal bushing of the transformer to be rectified and used as a measure of the crest value of the voltage. Another refinement is a switch that permits the standard air condenser to be used for voltage measurement or in the bridge circuit.



100-kV Schering bridge

Behind the enclosure is the standard condenser of the compressed air type with a working pressure of 100 lb. per sq. in., and the Ferranti input transformer of 20 kVA at 100 kV with a small induction regulator outside. The testing busbars suspended from the ceiling are of Ferranti make, together with the 750 mm. sphere gap. The lower sphere is movable up and down by a small motor in the pedestal, which is governed from the main Ferranti test-control desk on the gallery.

The main h.v. testing transformers are of Ferranti make, each containing 815 gallons of oil and arranged for single or cascade 500 kV operation. The first stands on the floor and the second on three porcelain insulator legs, each being rated at 250 kVA, single phase, 50 cycles, 1,250/125,000/250,000 V. They are energised by a 250/125-kVA, single-phase, 1,250/625-V alternator driven by a 70/35-b.h.p. synchronous motor. The fields of these two machines are, in turn, energised by two small generators driven in line by a double-ended induction motor, all by Newton Brothers (Derby), Ltd., the machines and main test transformers being remotely controlled from the gallery. These machines are housed in a near-by sub-station, together with a 75-kW Crompton Parkinson motor-convertor supplying d.c. through a Drake & Gorham four-panel switchboard; three Met.-Vick. 75-, 50-, and 200-kVA transformers, and Ferguson Pailin incoming a.c. feeder switchgear and metering equipment.

The layout of the laboratory with its five sources of very high voltage has necessitated the provision of a complete system of wire-mesh screens and gates with electrical and mechanical interlocks arranged for automatically cutting off the power and earthing the apparatus.

ferrous to ferric iron by oxygen during aeration, the conversion of ferric to ferrous iron by the metallic electrode or by hydrogen, and the influence of light on these several reactions, some of which have been recognised for many years.

Faraday Steels

In a fourth paper Mr. CARL BENEDICKS (Metallograiska Institutet, Stockholm) describes how he has determined the electrical resistivity of small specimens of steel prepared by Faraday. He has found that steels containing gold have unexpectedly high resistivities, while rhodium in steels produced in one specimen a very high, and in another a very low, resistivity. The influence of platinum, previously unknown, corresponds to one atomic per cent. of platinum, increasing the resistivity by 7 microhms per cm. per sq. cm.

One of the Faraday specimens was melted in a radiation furnace on two occasions, and the occluded gases were measured and analysed. In this connection a novel phenomenon, occurring with unilateral radiation, is described; sharp corners in a solid, bright specimen undergoing fusion show a remarkable resistance to melting, and give rise to sharp protuberances, elongated in the direction of the radiation. Another noteworthy phenomenon observed pertains to capillarity; on heating in a high vacuum, pure iron does not wet the crucible, while carbon steel does, this difference being due to a slight chemical reaction taking place in the latter case.

* * *

Condenser Stability

THE paper by Mr. H. A. Thomas, of the National Physical Laboratory, which was read before the Wireless Section of the INSTITUTION OF ELECTRICAL ENGINEERS in London on May 6th, gives an account of an investigation into the nature and causes of undesired changes in the capacitance and power-factor of electrical condensers, and outlines means of obtaining greater constancy. The author's principal conclusions are that the changes are almost entirely due to temperature variation. The thermal behaviour of condensers with solid dielectric is in general non-cyclic, and for a representative selection the temperature coefficients of capacitance ranged from −1,800 to +200 parts in 10^6 per deg. C. The thermal behaviour of air-dielectric condensers is not cyclic in general, but more nearly cyclic than that of solid-dielectric condensers, and cyclic behaviour was obtained in some cases. The coefficients of a representative selection ranged from −65 to +150 parts in 10^6 per deg. C. When the behaviour was cyclic the capacitance coefficient was between 2 and 3 times that of the linear expansion of the metals used.

An analysis of the causes of abnormally large coefficients showed that the variation of capacitance with air density is about 2 parts in 10^6 per deg. C. With entirely free expansion of metal plates, the coefficient is approximately that of the linear expansion of the metal, in accordance with simple theory. Variation of "fringe" and "stray" field with temperature has no appreciable effect on temperature coefficient. Change of residual internal stress in the metal plates and members with change of temperature is not in general a very important factor. Distortion due to temperature-gradients arising from inequalities of thermal characteristics of component parts is likely to be a significant factor in many cases. Variation of elasticity and moment of inertia with temperature is not significant. Unequal expansion of different parts may be a very important factor in producing large coefficients, particularly if the one set of electrodes is not quite symmetrical with respect to the other (*i.e.*, unequal air-gaps). Even when constraint is intended to be avoided by the free sliding of plates in grooves, the frictional constraint is likely to be sufficient to cause distortion. In air-dielectric condensers with equal air-gaps, constraints arising from inequalities of expansion of different parts suffice to account for coefficients of 2 or 3 times the theoretical value for free expansion; with slight inequality of air-gaps (a few mils only) the effect of any small distortion in the plates due to this or any other of the causes listed is very greatly enhanced.

An examination of the properties of insulating materials showed that the temperature coefficient of permittivity of solid dielectrics ranges from about −700 in 10^6 per deg. C. (high-permittivity ceramics) to about +2,000 in 10^6 per deg. C. This temperature coefficient may be significant in variable air-condensers. Ebonites, synthetic plastics, and a specimen of fused silica, showed non-cyclic thermal behaviour. Certain ceramics were very satisfactory in respect of deformation and cyclic behaviour.

Minimisation of temperature coefficients of capacitance requires elimination of residual stresses and of variation of mechanical constraint, uniformity of effective thermal mass in the various elements, and accurate location of a mechanically suitable insulator with a low temperature-coefficient of permittivity. Among the methods of compensation for temperature-change, the use of a solid dielectric with negative temperature-coefficient of permittivity has possibilities, but some serious practical limitations. There are practical objections to the use of "invar" or copper-plated invar. Bimetallic systems are practicable and effective. By the methods described in the paper it is possible to construct comparatively inexpensive air-dielectric condensers with temperature coefficients adjustable to values in the neighbourhood of zero for slow changes of temperature.

A short communication from Drs. R. W. Sloan and E. G. James was also read at the meeting on the transient time effects in diodes, saturated or unsaturated, in pictorial form.

* * *

Views on Railway Electrification

IN reviewing the progress of main line railway electrification throughout the world at the INSTITUTION OF ELECTRICAL ENGINEERS in London on April 30th (the paper was outlined in our last issue), Mr. E. R. Kaan made special reference to Austria, his own country. Mr. F. LYDALL, who opened the discussion, remarked that the extent of the electrification was remarkable, since most of the work had been done during the last few years. The Kando system employed on the Hungarian State Railways differed from all others in that three-phase current was used without conversion, the locomotives operating with single-phase a.c. at the same frequency (50 cycles) as the three-phase supply system. Experiments were also being made in Germany with the utilisation of a "high" line frequency, he stated. The reasons for electrification were usually commercial or political, but the improvement of traffic facilities was an important aspect which had been stressed in the Weir Report. Any scheme that would pay its way, even if the profit were not expected to be large, was worth considering from the point of view of providing useful employment. Surprise that so little had been done in this country was not confined to visitors from abroad. The Weir Committee never intended that electric traction should be completely substituted for steam locomotives. Mr. Lydall said he was sure that there were considerable portions of main lines in this country on which electric traction would pay.

In the opinion of MR. W. E. HIGHFIELD, the author might have said more about the difficulties that had to be overcome before a main line could be converted. The particular factors which had forced decisions abroad were not encountered at home. British railways were doing well, and the coal industry must be considered; the railways derived a good proportion of their revenues from this source. At the same time, electrical engineers knew that electric traction could do the work equally well, and perhaps more cheaply; but they would fail in their duty if they did not very closely consider how electric traction would fare in time of war. Steam locomotive design had improved very materially; had the electric locomotive designer shown similar progress?

MR. BRUCE WHITE considered it was a mistake always to treat main and suburban lines as separate propositions. For instance, in the Madras scheme a combined power and traffic controller enabled goods traffic within eighteen miles of the city to be put through at night, with a consequent material improvement in load factor which, in its turn, influenced the cost of power. Steam locomotives needed large areas at termini for maintenance purposes. Electrification would "clean up" termini, abolishing many locomotive accessory services whose cost was appreciable. Sooner or later this country would be forced to exclude steam locomotives from large city zones.

MR. C. E. FAIRBURN said that suburban traffic, unemployment, physical difficulties, conservation of coal, and smoke nuisance legislation were among the main reasons for electrification, but each factor had different aspects at home and abroad. The Colonies had fallen into line and all "easy" electrification had already been effected. Only "normal" lines remained; to enable them to be dealt with ideas must be revised and costs, too. Steam costs had been reduced and operation improved, but electric traction engineers had failed to "get a move on." MR. E. H. CROFT pointed out that any time-table would show that steam services in this country, apart from one or two main lines, were deplorable. If it were assumed that a fair proportion of main and all suburban lines would by force of circumstances eventually be electrified a gap

would still remain. In that gap there was a great future for railcars. To enable them to function properly they would need to have a large power-to-weight ratio and quick acceleration so that high schedule speeds could be maintained.

MR. H. H. SWIFT referred to different types of locomotive drives. MR. G. H. NELSON remarked that one of the reasons for electrification had been stated to be commercial, whereas it was more correct to say that it was economic. The coal question had delayed conversion in this country, but the present methods of using coal were very wasteful. Engineers should have some say in coal conservation matters and emphasise the falsity of the argument that because this was a coal country it would not pay to electrify the railways. Suburban electrification should be pushed out in rings round the larger towns; as the diameter of these rings grew the main line problem would solve itself. The monthly train-miles run on the Southern Electric system exceeded the Swiss mileage, while the power consumed was about the same in both cases. Weights must be reduced in order to save power and lower maintenance costs. The type of electric traction chosen mattered little, so long as the cost was the same in the end. More than 70 per cent. of the cost of conversion had nothing to do with electrical work or electrical materials, but it was that 70 per cent. which often killed electrification schemes. In view of the economic need, the comfort it would provide, and the service one would be rendering to one's fellows, electrification should not be delayed.

MR. H. J. BROWN suggested that the Central Electricity Board should be given power to sell electricity direct to the railways. MR. T. HORNBUCKLE said that he had seen some of the work the author had done in Austria, and he had been impressed with the fact that steam locomotive operation in that country left little to be desired; so it was not a case of replacing something that had become obsolete. Suburban services were so much improved by electrification that cost did not matter. That fact had prevented proper consideration being devoted to ways and means of providing better main line services at no greater price, with the added prospect of earning greater revenue.

MR. E. T. ROBERTSON remarked that the economic reasons for electrification were fairly well known. Regarding policy, surely it was better to burn coal in bulk rather than inefficiently in small quantities? More effort should be made to standardise methods, voltages, and systems. MR. CARTY referred to the high speeds attainable by electric trains, and pointed out that in France there was a rule that all electric locomotives should be capable of running on third rail as well as overhead collector wire systems.

The author reserved his reply to the discussion for the I.E.E. Journal.

* * *

The I.E.E. Annual Report

THE report of the Council of the Institution of Electrical Engineers, which was presented at the annual general meeting in London yesterday, reveals a total membership of 16,788, representing a growth of 638 during the year ended March, 1936. The deaths recorded number 115. Graduateship examinations were held at nine centres at home and in ten countries abroad. The national certificates in electrical engineering awarded jointly with the Board of Education numbered 737 ordinary and 438 higher (plus sixty-one higher endorsements) and fifteen ordinary and seven higher diplomas in England and Wales; in Scotland the numbers were twenty higher and six ordinary certificates and seventeen higher diplomas. Nine scholarships and two grants for research were awarded.

Regarding the Institution's headquarters, the report states that the ventilation and acoustics of the lecture theatre are to be improved this summer, while an electrical thermal storage system is to be installed in place of the present coal-fired boilers.

The average attendance at the fourteen ordinary meetings in London was 246, compared with 241 in the previous session. A new sub-centre is to be formed at Belfast. The Wireless Section, with a membership of 782, had an average attendance at its meetings of 196 as compared with 130 in the previous session, while at the four wireless informal meetings the average attendance was 280 against 363. The Meter and Instrument Section (membership 638) had an average attendance at its meetings of eighty-one, compared with ninety-nine; demonstrations will continue to be encouraged. The Transmission Section has a membership of 1,621, the average attendance at its seven meetings being eighty, while works visits were included in the section's activities. The attendance at the eleven informal meetings was eighty-five, against ninety-four. The nine Students' Sections have an aggregate membership of 3,836, including 1,772 graduates under twenty-eight years of age. The total attendance at ten lectures was 680, compared with 730.

This year's Faraday lecture (which was repeated in London yesterday) has been attended by a total audience at seven centres of 7,550, of whom over 6,300 were non-members. The corresponding figures for eight lectures last session were 4,840 and 3,828. The annual conversazione was attended by over 2,000 members and guests and 900 were present at the annual dinner.

During the year 352 books and pamphlets were presented to the reference library, and 98 volumes were purchased. Readers totalled 7,517, of whom 593 were non-members. To the lending library seventy new volumes were added and 3,384 books were issued to 1,317 borrowers.

An oil painting of Col. R. E. B. Crompton was presented to the Institution last November by Lieut.-Col. K. Edgcumbe and a portrait in oils of Mr. Sydney Evershed has been promised. To the collection of talking films of eminent electrical engineers there have been added films of Dr. F. B. Jewett, Lord Hirst of Witton and Lord Rutherford of Nelson.

The I.E.E. *Journal* continues to grow, the two 1935 volumes containing 1,652 pages, excluding plates, compared with 1,474 pages in 1934. Some 842 members subscribed to both the physics and electrical engineering sections of *Science Abstracts* and 595 to the physics section only.

The assets of the I.E.E. benevolent fund totalled £26,803. During 1935 grants made to sixty persons totalled £2,987, while donations and subscriptions amounted to £3,327. At present 31 per cent. of the I.E.E. members subscribe to the fund.

The I.E.E. revenue account shows a surplus of £6,088, compared with £8,517 in 1934. The assets have appreciated by £4,939 to £206,704.

* * *

Electron Liberation

The twenty-sixth May lecture to the INSTITUTE OF METALS was delivered in London on May 6th by Mr. C. C. Paterson, G.E.C. Research Laboratories, who gave experimental demonstrations with the aid of thermionic valves, photo-electric cells, electric-discharge lamps, and other electronic devices to exemplify his theme, which was the escape of electricity from metals and its practical consequences. The lecturer traced the effect which the liberation of electrons from metals has had on the trend of electrical engineering during the past twenty years. Mr. Paterson pointed out that he was not a metallurgist but an electrical engineer who, for the moment at any rate, found in the other sciences, of which metallurgy was by no means the least, the key to most of the new advances in his own profession.

Standard Radio Valves and Plugs

IN the interests of the user it is essential that the various types of radio valve should be interchangeable as between one make and another. The dimensions necessary to ensure this are given in a British Standard Specification (No. 448-1936) which has just been issued as a revision and extension of a specification which was published in 1932. The new edition deals fully with the bases of the 7-pin and 9-pin valves and with the corresponding valve-holders, as well as retaining the previously published details of the 4-pin and 5-pin types. In addition, a number of refinements have been introduced with a view to securing both contact between the valve-pins and the contacts in the holders. The specification is therefore of direct interest not only to the manufacturers of valves, but also to the makers of valve-holders and of complete receiving sets, while gauging is very fully dealt with.

There has long been a demand for a special plug and socket for the connection of headphones and loud speakers in such places as hospital wards and blocks of flats, so as to secure proper interchangeability and at the same time to guard against the possibility of the instruments being plugged into sockets connected to the supply mains. Suitable connectors for these purposes are now provided for in a new British Standard Specification (No. 666-1936) in which two alternative types are standardised, one being a flat-bladed plug and the other of the jack pattern, for not more than 50 W or more than 80 V above earth.

Copies of these specifications may be obtained from the Publications Department, British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s. 2d. post free each per copy.

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

High Electricity Charges

I have read with interest recent articles and correspondence regarding the comparative cost of gas and electric services. Expert opinions indicate that to be an economical proposition the "all-electric" house must be supplied with electricity at a price not exceeding ¾d. (actual) per kWh consumed. Yet large numbers of domestic consumers are paying considerably more than this. I found on inquiry of two entirely separate supply companies in the North Kent area that their standing quarterly charges on a small six-roomed house of 680 sq. ft. ground floor area were £1 2s. 6d. and 18s. 9d. respectively, with electricity at 1d. per kWh. Taking the lower figure and assuming a consumption of 2,400 kWh per annum (a high figure for such a small house accommodating two or three persons) the cost is 1.2d. per kWh!

Neither company supplies cookers on "hire and maintenance" but only on hire-purchase, with maintenance, for eight years, at 10s. 6d. per quarter for the smallest size. It is significant to note that in each case no gas was available. Incidentally, these high charges contributed largely to my decision against purchasing the before-mentioned house assessed at 22s. 6d. per quarter.

As the grid was intended as a *national* scheme of distribution and the C.E.B.'s report shows considerable savings due to increased working efficiency, why is it that in some districts the cost of electricity makes the "all-electric" house a practical proposition and in others an expensive luxury? How long will such unequitable charges exist? A. H. THOMPSON.

New Eltham, S.E.9, *April 28th.*

"A Contractor's Plea"

The article by Mr. J. Bland in your last issue is another instance of how supply authorities are getting away with the idea of imposing all sorts of harassing restrictions upon electrical contractors who happen to be ignorant of the state of the electrical law in this country.

Does not Mr. Bland know that if his installation complies with current I.E.E. Regulations no supply authority has power to refuse connection? The next time he is asked for all sorts of freak details in any area let him politely inquire for the authority from the Electricity Commissioners for the requirement; if it is not forthcoming, he is not bound to comply.

One is tired of hearing contractors, more especially those unconnected with any trade organisation, stating: "You can't do that, the supply authority won't connect," or "The supply authority won't allow 1/.044 in this district" with reference to matters clearly approved by the Institution Regulations. Mr. Bland's article suggests that he, at least, should know better; yet he apparently acquiesces in an attitude of submission to a supply authority that refuses to connect an installation with inspection conduit fittings.

As another contractor I cannot agree that the supply authority should be the final arbiter as to what shall or shall not be connected. This attitude may be sound where the authority runs no installation department of its own. Where, however, the authority is in open competition with the contractor it is contrary to all ideas of fair play that it should have the power to inspect and refuse a competitor's work on the grounds that some local detail of a pettifogging nature has not been included. In many cases the extra detail demanded of the contractor is conspicuous by its absence in the supply authority's own installations; I know of one district at least where the authority insists, quite rightly, upon complete earthing of all iron-clad switchgear in small houses; but it omits to earth its own service cut-outs or meters.

The supply authority must, of course, have the final word as to how its mains are to be utilised, and I generally show respect to requirements as to balance, &c., regarding any installation. I do not, however, sit down under all sorts of local requirements not demanded by the Tenth Edition. The less we hear of such "pleas" in the future the better for the contracting industry. Of course, other firms "get away with it" because they happen to know that many supply authorities' demands have no legal standing.

It was disheartening to read in the same issue of the ELECTRICAL REVIEW that during negotiations regarding municipal trading at Southend it transpired that the great majority of contractors and electrical traders in that town were not connected with any trade organisation. It was stated that sixty traders were outside the organised body that conducted the negotiations, and it is apparently not yet realised that the greater the strength of the organised men the better the advantages that can be secured for the contractor in all cases of municipal trading. The answer to the query as to how supply authorities manage to keep the contracting industry in such abject subjection in the matter of installations is that the outside contractor does not know the electrical law of the land.

Folkestone, *May 2nd.* T. C. GILBERT.

I read with special interest Mr. J. Bland's remarks concerning continuity testing. It is true that the crude methods to which he referred are still very widely employed, but my experience differs from his in that the continuity test is, at least in a very great many instances, quite religiously carried out. I was surprised that no reference was made to the most modern of all "Meggers," namely, the Evershed "Meg" insulation and continuity tester, an instrument which I must have seen advertised in your journal consistently during the last year or two. As the name implies, this double-purpose instrument enables the user to make not only the normal test for insulation resistance, but also the relatively very low resistance of the earthing conductor circuit can be measured without further apparatus. In fact, the continuity test range is 0-100 ohms, a particularly attractive characteristic being that the all-important one-ohm mark is, with great advantage, situated nicely in the *middle* of the scale which is drawn alongside the calibration for insulation resistance.

Apart from engineers of supply authorities, many of the more enterprising and leading contractors use this type of instrument, while in cases where the expense of a new "Megger" cannot be sanctioned or met, a small ohmmeter specifically designed for the job is used as an adjunct to the existing insulation testing set.

In surveying the situation my impression is that, among engineers generally, the continuity test has certainly reached a stage of considerable importance, so much so, indeed, that it will not be very long before it is regarded by all who have need to be interested as on a par with, if not more essential than, the insulation resistance measurement.

Wembley Park, *May 4th.* S. H. PARSONAGE.

Overloaded Lampholders

Rule 606(B) of the I.E.E. Regulations specifically states that a lampholder plug shall not be used in connection with any appliance taking more than 2 A. It is regrettable to see so many types of domestic portable apparatus about still using a lampholder adaptor. Only last week I noticed in the technical Press that a manufacturer provides a combined plug and lampholder adaptor for a portable piece of domestic apparatus rated at 600 W. This practice cannot be too strongly deprecated as apart from the trouble due to the high current there is no practical means of earthing.

I realise that the method of connecting up is not all the manufacturer's fault, but why provide a combined plug and lampholder adaptor? Would it not be better to omit this and supply a length of flex only? Then if the apparatus is connected up by a registered contractor we may be assured that the installation will comply with the Regulations and we shall have taken a step forward in ensuring the absolute safety of the public as regards portable domestic apparatus.

April 29th. MEMBER A.S.E.E.

The Meter Engineer's Status

In reply to the remarks of "A. A." on my original communication, while admitting that "all testing" is perhaps rather too sweeping a statement to make, I think that he might agree with me were I to qualify those words by adding "where accurate results with precision instruments are required," I should also like to call his attention to the importance of the rest of that paragraph, namely, "provided that the above fundamentals are observed and the department is organised with this end in view."

Generators (on the electrical side) and power transformer testing are certainly not beyond the ability of the properly organised meter department; in fact, such tests have been arranged and carried out in my own experience (25,000 kVA alternators and up to 1,000 kVA transformers) with the co-operation of the electrical maintenance engineer—not under his guidance, a very different matter where responsibility is concerned. The technical man for this job should be one who uses electrical instruments every day, knows how to handle them, how they are calibrated, what to expect of them, and therefore to what degree of accuracy he may rely on his results. The technical assistants in large power stations are chiefly interested in steam and coal consumption, turbine and auxiliary plant efficiency, &c., and electrical tests with precision instruments are outside their daily tasks.

Surely "A.A." 's electro-technical engineer is the same as my meter and testing engineer, except that the latter is, in addition, fully experienced in meter and instrument work, to my mind the proper foundation for efficient and reliable testing. Should not the section supervisor mentioned in the same paragraph be designated a meter "supervisor" and not a meter "engineer"?

It seems to me that the whole question of the M.E.'s status is one of designation. The possibility of standardising designations within the supply industry, together with the general scope of duties to be applied to each, should be investigated. At the present time the words (meter) supervisor, superintendent and engineer are used rather loosely as if they were synonyms, and this attitude creates stumbling-blocks for those who seek improvement.

In the case where the meter engineer is only capable of looking after the meter side, it is because the salary attached to the post is not sufficient to attract the right type of man, and the position has, therefore, been filled by one whose technical knowledge is limited. Obviously, under these conditions, the professional status of the competent meter engineer is considerably depreciated. Nevertheless, whatever designation may be given to him and no matter how rigidly he may be kept to his nominal job, I still maintain that he is worth more as such in the profession than, in the majority of instances, his monthly pay cheque indicates.

It remains for such bodies as the E.P.E.A. and N.J.B. to tackle the question of standardising and adding to the designations in their grading scheme, a matter in which, I venture to suggest, they should take immediate interest. Perhaps (who knows?) in a new shuffle the meter man will come into his own!

E. C. M.

May 2nd, 1936.

Radiogram Consumption

I have recently carried out some tests to obtain the consumption of an "all-mains" radiogram. The set in question is a d.c. model, the radio load being 70W and the gramophone load 110W.

The tests covered a period of sixteen weeks, commencing in October last. I found the average weekly consumption to be 754 Wh, the highest weekly consumption 1,100 Wh, and the lowest weekly consumption 350 Wh.

It is, of course, difficult to place any value on such statistics as they are influenced by widely different variants, the most important factor being, presumably, the matter broadcast; secondly, the tastes of the user, and last, the habits of the user. Nevertheless, I trust the information will be of some interest.

A. B. CATLING, A.M.Inst.C.E., A.M.I.E.E.
Deputy Borough Electrical Engineer.

Barking, *April 30th.*

The Age of Fabrication

To-day it is fashionable to fabricate our electrical engineering wares. We have now the welded or fabricated steam boiler, which has been passed by the critics, but why not go a step farther and have a fabricated or welded steam casing for a turbine? How would it compare in cost and strength with cast-iron or steel? What are the arguments for and against such a step?

I should value very much the comments of our turbo designers and others on the subject. Perhaps a more feasible suggestion is a fabricated shell or case for a surface condenser.

HUGH L. TAYLOR.

Market Drayton, *May 4th.*

Ampere-hour Meters. By G. W. Stubbings, B.Sc., A.M.I.E.E.

A revival of interest

IN reviewing the developments which have taken place during recent years in the design and construction of electricity meters, it is somewhat remarkable to notice the revival of interest in d.c. ampere-hour meters, particularly in those of the mercury motor type. When d.c. distribution seemed likely to be superseded entirely by the a.c. system, the once familiar mercury meter looked like becoming almost obsolete. For reasons which need not be discussed here, this threatened obsolescence has not taken place, and modern examples of this type of meter are now available whose characteristics are very much superior to those of the meters in use during the early years of the present century.

When the d.c. system of distribution was at the height of its popularity there was a considerable demand for a cheap and reliable meter for small supplies. There were two early varieties of d.c. watt-hour meter available, namely, the clock and the dynamometer types. The first of these was costly and complicated, and the second was not very reliable. When the mercury motor d.c. watt-hour meter was first developed it offered no advantages, in point either of cheapness or reliability, in comparison with the other available types. The assessment of consumers' supplies on the basis of true energy consumption as given by the registrations of a watt-hour meter was then almost impracticable, and it was probably due to this that those responsible for the drafting of the Electricity Acts definitely permitted the charge for consumers' supplies to be based upon quantity, thereby legalising the ampere-hour meter.

An Ill-fated Competitor

During the first decade of the present century the mercury motor d.c. ampere-hour meter was probably used to a greater extent than any other type. Its supremacy was for a time threatened by the development of a cheap ampere-hour meter of what was then called the commutator type, but this threat was ephemeral, and the commutator meter, after a brief spell of popularity, sank into practical oblivion under the weight of its own defects. The early types of mercury ampere-hour meters were far from perfect. They had considerable temperature errors, and the speed/load characteristic was only approximately linear. Further, the maintenance costs were considerable. In modern patterns of this type of meter these defects have been largely overcome.

The revival of interest in the d.c. ampere-hour meter suggests a reconsideration of the question, once keenly debated, of the desirability of assessing consumers' supplies on a basis of quantity instead of true energy. In these debates it was often stated by those interested in the sale of ampere-hour meters that the difference of the registrations of an ampere-hour meter and a watt-hour meter connected in series to measure the same supply would for practical purposes be negligible. Whether these statements were based upon the results of experiments or were merely the expression of pious hopes is not known, but, in view of the very considerable voltage variations which are allowable at the present time, the inherent limitations of the ampere-hour meter are sufficiently serious to call for some consideration.

Penalising Peak-load Consumers

An ampere-hour meter measures quantity and automatically converts this quantity into equivalent energy at a fixed nominal voltage by means of the gearing of the register clock. If the consumer's supply pressure is below the nominal voltage for which the gearing of the clock is designed, the rate of registration will be too rapid, and *vice versa*. In the early discussions on the question of quantity *versus* energy metering it was frequently stated that this feature of the ampere-hour meter favoured the supply authority, since at times of peak load, when the voltage is likely to be lowest, meters would register fast. It also follows that a consumer who takes the bulk of his supply at times when the total load on the system is small will have his meter registering slow, since the voltage at these times is likely to be above that for which the meter gearing is designed. Thus, if the voltage at consumers' terminals were the maximum allowable, the consumer who used his supply at the time of peak load on the system when the voltage was lowest would have his supply registered 6 per cent. high by an ampere-hour meter, whereas another consumer who used the supply at off-peak times would be undercharged to the extent of 6 per cent.

This feature of the ampere-house meter in over-registering peak load supplies, and under-registering off-peak loads, automatically adjusts the virtual rate of charge per actual kWh used in accordance with the scientific theory of charging according to which the cost of supplying a unit at times of peak load is greater than during off-peak periods. The possible difference of twelve per cent. in the rates of registration of an ampere-hour meter per kW is certainly very large, but the circumstance that this difference is, from the point of view of the supply authority, in the right direction raises the practical question as to how far it is legitimate to use a faulty system of metering which automatically corrects for the greater cost of production of energy used during the times of peak demand.

The apparent defect of the ampere-hour meter is really an advantage, from the point of view of the supply authority. From that of the consumer the meter performance is inequitable, since the greater the inconvenience suffered by him due to low voltage the greater is the rate of overcharging.

Since the use of ampere-hour meters for d.c. supplies is based upon considerations of expediency rather than on principle, its characteristics must be accepted. The difference in the prevailing methods of metering d.c. and a.c. supplies is, however, certainly striking, and is hardly in conformity with that ideal of exactness of measurement which is now generally held.

Spring Cleaning Electrically

Vacuum cleaners and floor polishers to aid the housewife.

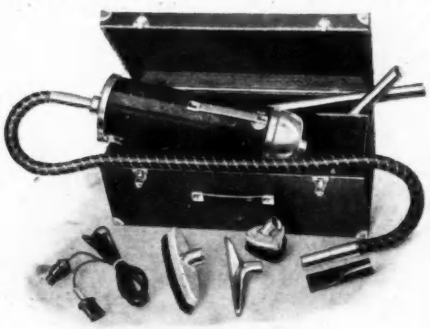
SPRING cleaning time is here again with its accompanying household upheavals, but it brings with it the best vacuum-cleaner selling opportunities of the year. Those who have one have learnt that cleaning is a relatively quiet affair when the dust and dirt have been removed consistently and effortlessly by the electric cleaner during the year, but there remain a vast number of people who have not yet profited from the benefits of cleaning electrically. This is the time at which at least some of these will become ready converts.

The array of models from which the housewife can choose is extensive, and they range in price from less than £3 to over £20. But all can be classified broadly into three main types, the canister, cylinder and bag designs. Their use is simple and the loading so low that they can be used upon the lighting circuit, while a life of many years can be expected provided reasonable precautions are taken, such as maintaining a clean bag and switching off occasionally when the cleaner is continuously in use for long periods. Whether large-volume air displacement or suction power alone is the main thing to be considered is still debatable, each view having its own supporters among the manufacturers. It would appear that really adequate suction is difficult to obtain cheaply, and that unless there *is* sufficient to draw the dirt through the carpet, the case for air-flow requires very careful consideration. Probably the most satisfactory compromise in the case of cheap machines is reasonable air-flow and the use of a brush with which to stir up the dust.

The canister models are quiet and highly efficient, but have not become as popular as they deserve to be largely because of price and lesser portability. The "Tellus" (225 W) and "Norfolk" (200 W) are both circular in shape, while the "Welbeck," which has a 175 W B.T.H. motor, possesses a square canister. The efficiency of this is due to the fact that the filter never becomes clogged with dust. The motor is situated at the top of the canister and draws air out through a suspended bag; a swirling action prevents the dust from clinging to the bag, and instead it is deposited in the canister; the square-shaped "Welbeck" machine aids deposition of dust.

Next in price is the bag pattern. Since this type is necessarily more expensive to make than the cylinder design it is, generally speaking, confined to the "quality" machines and is fitted with a powerful motor. An advantage which it has over all the others is that it is always ready for instant use without attachments that need extra storage space, but in favour of the cylindrical type is the flexible tubing which is used, enabling it to be employed for cleaning curtains, chairs, &c.

Almost all external bag cleaners employ some kind of brush, usually revolving. Those cleaners fitted with brushes must necessarily have nozzles of a larger area which are more easily held in the correct position. Among this type are the "Universal," "Silobeta," "Streamline," "Hoover," "Hotpoint," "Siroma," "Kenmore" and "Vactric."



An example of the cylinder-type—the "Summit"

The others employ a narrow aperture and rely on the suction-created velocity of the air for the cleaning action. A few examples of this type are the "Duchess," "Dizer," "Eureka," "Magnet," "Thor," "Eddo," "Apex" and "Airway" machines.

The "Bustler" and "Goblin Wizard," although of the bag type, have the motor and bag "in line" with the handle so that the top part of the handle can be removed to convert them into hand machines. The all-insulated case is another feature which is common also to certain "Bylock" models, the "Silobabs," "Auto-Maid" and "Dustmaster," all of which are of the cylinder type. The "in-line" construction is also a feature of the "Goblin-Ideal," but in this case the machine is of the cylindrical type with fixed extensions at either end. Most vacuum cleaners have fabric bags which have to be cleaned, but the "Dizer" (which also embodies a glass window enabling the user to watch the dust flow) and the "Siroma" have special bags that are destroyed after use; the "Air-Way" also employs this method.

Generally speaking, the cylindrical vacuum cleaners cost under £8, but there are a few *de luxe* models, including the "Goblin Wizard," "Goblin Major," "Goblin Triumph," "King Dick," "Champion," "Electrix Super," "Bedalax," "Efesca Major," "Black Lion," and "Eleta." Cylindrical cleaners are obtainable for as little as under £3. Some of the low-priced machines are the "Red Lion," "Northern," "Little Billy," "Minorette," and the "Stewart" "walking stick" style, while in between is the "Summit." It is general practice to mount this type of cleaner on runners, but the "Monarch Major," "Jubilee" and "Dustmaster" can also be obtained mounted on wheels. A novel note is struck by the "Rotarex" with its "spun" case in the shape of a spinning top.

At a price of three or four pounds a number of hand machines are made for dusting purposes; for example, the "Duco," which can be fixed to a handle to form a full-size vacuum cleaner, "Universal" and "Kenmore," while for less than £2 the "Gilbert" hand cleaner is obtainable. There is an almost unbelievably wide range of accessories which can be operated from a vacuum cleaner, extending from ordinary cleaning equipment to dog grooms and paint sprayers. Certain vacuum cleaners (the "Duchess," for example) have a horizontal revolving disc brush which can be fitted for floor polishing, while the "Hotpoint," "Silovac" and "Silobeta" are convertible in the same way except that cylindrical brushes are used. There are several floor polishers pure and simple: a cylindrical brush is used in the "Duco" and "Polifloor," but a single disc type brush in the "Junior Polifloor" and "Supreme"; two brushes of this type are used in the "Magnet," "Electrona," and "Vactric," and three in the "Electrolux." In addition, a floor scrubber and dryer is made by London Electric Appliances.

That it is quite impossible to men-

The "Stewart" walking-stick type

The new "Efesca" hand-cleaner

The new "Kenmore" model employing a revolving brush

D

New Apparatus and Devices

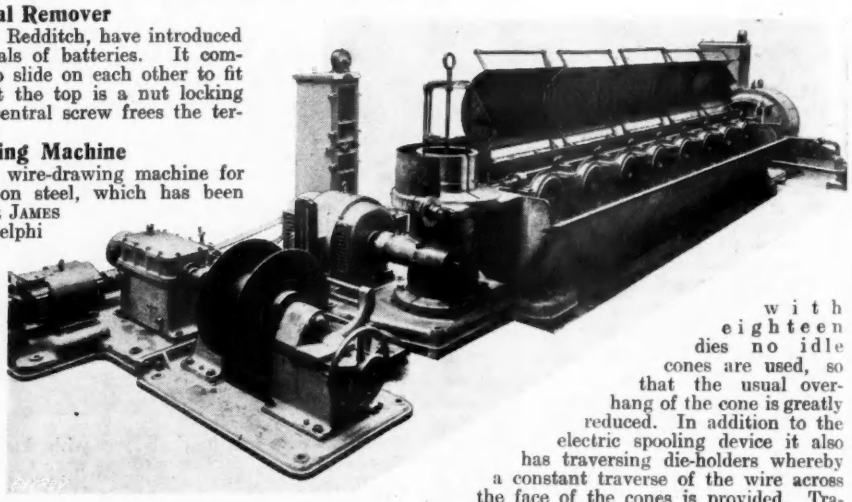
for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

A Battery Terminal Remover

MESSRS. H. TERRY & SONS, LTD., Redditch, have introduced a device for removing the terminals of batteries. It comprises two U-shaped pieces, free to slide on each other to fit the underside of the terminal. At the top is a nut locking the halves together; turning the central screw frees the terminal.

Modern Wire-drawing Machine

A nine-hote continuous non-slip wire-drawing machine for No. 12 to No. 21 (finishing) carbon steel, which has been recently introduced by MESSRS. SIR JAMES FARMER NORTON & CO., LTD., Adelphi Iron Works, Salford, has an incorporated motor and four-speed drive, and is provided with individual clutches of the coil type for each block. Special trip-switch and plunger mechanism ensures that in the event of wire breaking on any particular block all the preceding blocks are automatically stopped. The pulling clutches operate without "snatch" on the wire. The blocks and die boxes are water-cooled, and the driving shaft and gearing run in oil in a totally enclosed chamber. Forced lubrication is provided for the bearings.



Nine-hote continuous non-slip heavy-wire drawing machine

Other modern equipments produced by the same company include an under-liquor drawing machine (TF3A) for carbon or mild steel with eleven dies for from No. 20 to No. 30 gauges. The wire is strung-up on the machine while the cones are in the horizontal position. Afterwards the drawing cones and dies are swung into the vertical position and become entirely immersed in the liquor tank in which position the wire is drawn. The turbulence of the drawing liquor keeps the dies and cones cool. The driving motor is mounted direct on top of the gear box.

Model T.F.3B. has twenty-one dies for copper wire from No. 20 to No. 42 (finishing) gauges, and an electric wire spooling device which ensures that the wire is wound with even tension throughout the depth of the bobbin. The tension can be regulated. The motor and "Texrope" drive are served by a special relay system which gives a low threading speed and a running speed.

On a high-speed fine-wire (No. 36 to No. 47 gauges) machine with eighteen dies no idle cones are used, so that the usual overhang of the cone is greatly reduced. In addition to the electric spooling device it also has traversing die-holders whereby a constant traverse of the wire across the face of the cones is provided. Traverse of the spooling gear is in a straight line and provides an even lay on the spool. The drawing speed is up to 5,000 ft. per minute.

Lug Grip Switch-boxes

The accompanying illustration shows the new lug grip switchbox which was recently introduced by MESSRS. FITTER & POULTON, LTD., Balsall Heath, Birmingham, 12. It is designed to take a semi-recessed switch but is available also in ceiling rose and flush switch types. A detailed description of this development was published on page 425 of our March 20th issue.

The F. & P. lug grip switch box

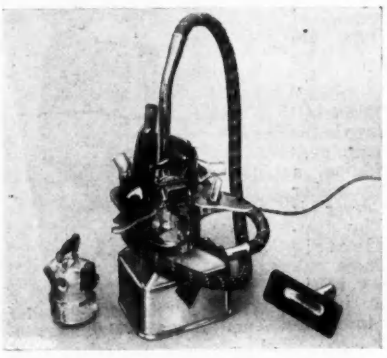
Spring Cleaning Electrically

(Continued from preceding page)

tion every cleaner on the market is obvious when it is realised that one maker informed us that, in addition to making its own cleaner, the company manufactured for more than a hundred concerns which sell the cleaners under their own names. A list of the companies whose products are mentioned above is appended, the type of cleaner being given in brackets. The picture in the heading was taken at the showrooms of the Westminster Electric Supply Cpn., Ltd.

We give below the names and addresses of the companies whose products are referred to in the foregoing article. The types of cleaners supplied are shown in brackets thus: (C)=cylinder; (K)=canister; (B)=external bag; (b)=with revolving brush; (H)=hand type, and (P)=polisher.

Abingdon Works (1931), Ltd., Tyseley, Birmingham, 11. (C.), KING DICK, CHAMPION.
Air Ways, Ltd., Abbey House, Baker Street, London, N.W.1. (B.)
Auto Maid Vacuum Cleaner Co., 62, Blandford Street, London. (C.), AUTO-MAID POPULAR.
British Electric Equipment Co., Ltd., 12, Norfolk Street, London, W.C.2. (K.), NORFOLK.
British Electric Domestic Appliances, Ltd., Bedal Works, Kings Way, Waddon, Surrey. (C.), BEDALAX, MARY ANN.



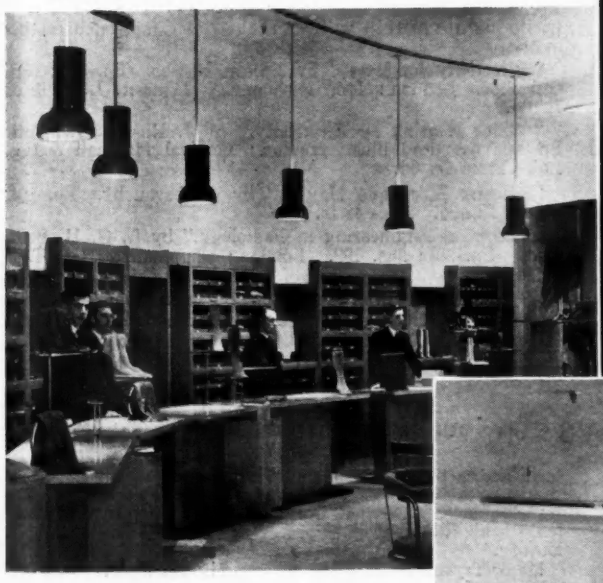
The accessories for the "Welbeck" cleaner shown held in a rack round the side

British Electrical and Manufacturing Co., Ltd., 7, Cavering Place, Newcastle-on Tyne. (C.), MONARCH MAJOR.
British Vacuum Cleaner and Engineering Co., Ltd., Parsons Green Lane, London, S.W. (C. B.), "GOBLIN," "CLEAN SWEEP," "ACE," "IDEAL," "WIZARD," "TRIUMPH."
Brown Bros., 20/24, Great Eastern Street, London, E.C.2 (C. P. H.), DUCO.
Bustler Electric Co., Ltd., Bank Chambers, 1a, Watling Avenue, Burnt Oak. (B. H.), BUSTLER.
British National Electrics, Ltd., Newarthill, Motherwell. (B. Bb. H.), UNIVERSAL.
Bylock Electric, Ltd., 103, South Street, Ponders End, Middlesex. (C.), BYLOCK.
Cooper-Stewart Engineering Co., Ltd., 136, Long Acre, London, W.C.2. (C.), STEWART, DUSTMASTER.
C.C.A. Vacuum Cleaners, Ltd., 138, Lever Street, E.C.1. (C.B. Bb. P.), SILOVIM, SILOVAC, SILOBETA, POLIFLOR, SILOBARS.
R. G. Dixon & Co., Ltd., 116, Victoria Street, London, S.W.1 (B.P.), DUCHESS.
M. C. Dizer, Ltd., 1, Broad Street Place, Finsbury Circus, London, E.C.2. (B.), DIZER.
Drake & Gorham Wholesale, Ltd., 77, Long Acre, London, W.C.2. (C.), MINORETTE, MINOR.
Electrolux, Ltd., 153, Regent Street, London, W.1. (C.P.), ELECTROLUX.
Electrona Electrical Products, Ltd., Friday Street, Manchester, 4. (P.), ELECTRONA DUPLEX 75.
Eureka Vacuum Cleaner Co., Ltd., 8, Fisher Street, London, W.C.1. (B.), EUREKA.
Electrix, Ltd., Dagenham. (C.), SUPER, POPULAR.
Falk, Stadelmann & Co., Ltd., 83-93, Farringdon Road, London, E.C.1. (H.C.), EFESCA.
A. C. Gilbert & Co., 109, Kingsway, London, W.C.2. (B.H.), POLAR CUB.
General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2. (B.), MAGNET.
L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, London, W.C.2. (Bb. H.), BEAT-A-BRUSH, STREAMLINE, FERRET.
Hoover, Ltd., Perivale, Greenford. (Bb. H.), HOOVER.
Hotpoint Electric Appliance Co., Ltd., 24, Newman Street, London, W.1 (Bb. P.), DUPLEX, JUNIOR.
Hurley Machine Co., Ltd., 55, Oxford Street, London, W.1. (H.B.), THOR.
Hogan & Wardrop, Ltd., 25, Old Street, London, E.C.1. (C.), LITTLE BILLY.
London Electric Appliances, Ltd., 62, Glengall Road, London, S.E.15.
H. G. Moseley & Co., Ltd., Hospital Street, Birmingham. (B.), EDDO.
A. Morris & Co., 46, Commercial Street, London, E.1. (C. P. H. Bb.), SIROMA.
Northern Steel & Hardware Co., 7, Gartside Street, Manchester, 3. (C.), NORTHERN.
Rotapex, Ltd., 65, Mortimer Street, London, W.1. (C.B.), ROTAREX, APEX.
Sloan Electrical Co., Ltd., 54, Fetter Lane, London, E.C.4. (C.), SUMMIT.
Sunbeam Vacuum Cleaner Co., Ltd., 28, Shepperton Road, London, N.1. (C.), LION.
Searsint, Ltd., Thames House, Millbank, London, S.W.1. (B. Bb. H.), KENMORE.
Tellus Vacuum Cleaner, Ltd., 68, Victoria Street, London, S.W.1. (K.), TELLUS.
Vactric, Ltd., Waterloo Road, North Circular Road, London, N.W.2. (C. Bb. H.), POPULAR, SILENT Q, AIRFLOW.
Vacuums, Ltd., Kingstanding Road, Birmingham, 20 (C.), ELETA.
Welbeck Co., 94, Baker Street, London. (K.), NEW WELBECK.
W.R.C. Household Machines, Ltd., Cobbald Road, London, N.W.10. (C.), JUBILEE, POPULAR.

Up-to-date Shop Lighting Methods

THE new men's store which has just been opened by Messrs. Simpson on the site of the old Geological Museum in Piccadilly, London, is an excellent example of the way in which artificial illumination, in addition to directing attention to the articles displayed, is a definite asset as a decorative medium.

At night-time, in particular, the premises compel inspection, the whole of the exterior being floodlighted in red, green and blue. Shadowless lighting has been attained in the non-reflecting windows by the use of a combination of concealed footlights and what may best be described as "egg-box" fittings above. Over the counters at frequent intervals has been erected a novel type of pillar-like fitting designed especially to direct the light where it is most required, the lower part of these fittings being slightly larger in diameter than the top in order to include a series of diffusing glass cylinders. Attention is also focused on articles of particular interest by means of spot-lights fixed on the pillars. An oxidised silver finish is used for all these fittings to harmonise with central circular ceiling fittings of the semi-indirect type incorporating pale green frosted glass.



At Messrs. Simpson's new men's store in Piccadilly, London, special fittings are used to concentrate light on to the display counters (above), while novel lighting is employed in the gift department (bottom right). The remaining photograph was taken looking up the staircase well and shows the one-piece 90-ft. long fitting

In the hairdressing and gift section are, in addition to partly recessed pendants, two metal fittings of very modern design incorporating fifteen vertical sections with cross-pieces at intervals. Some of the articles on view are thrown into relief by placing them in alcoves illuminated by lamps hidden below. Concealed cornice lighting is employed entirely in the snack bar, while a pleasing effect is obtained in the dress clothes section by utilising architectural lamps for decorative purposes.

Perhaps the most interesting and unusual feature of the whole installation is the 90-ft. long lighting fitting in the staircase well. Totally enclosed lamps are connected every few feet to a central chromium-plated tube, which is suspended entirely from the top ceiling with no support at the bottom or between floors.

The electrical work was carried out by Electrical Installations, Ltd., the special lighting fittings for the showcases, &c., being supplied by Messrs. C. Harvey & Co., and those for the offices by Messrs. Best & Lloyd, Ltd. The exterior floodlighting was installed by Claude General Neon Lights, Ltd. "Synchromains" clocks, "Dictagraph" automatic telephone equipment and "Express" lifts are fitted in the building.

New Books

Principles of Combustion of the Steam Boiler Furnace. By A. D. Pratt. Pp. 112; figs. 7. London: Babcock & Wilcox, Ltd.

This publication contains in remarkably compact form the essential technical data required by a combustion engineer to supplement his experience of furnace operation. The underlying idea of the author is that the only field for appreciable improvement in steam raising lies in the efficient generation of heat in the boiler furnace. Combustion being primarily a chemical process, the first part of the book is devoted to the chemistry and physics of the subject, including sections on specific heat and air for combustion, flue gas analysis and losses.

There is an excellent summary of the general requirements of proper combustion, three of which the author tersely defines (after a more detailed explanation) as "turbulence, temperature and time" (*i.e.*, for expansion of the gases). He does not, however, underestimate the difficulties of securing satisfactory results from general considerations as (assuming sound engineering design and adequate temperatures) other controlling factors, such as air admission and mixture, vary so greatly with different fuels that each case has to be considered on its own merits. Nevertheless, the typical examples of fuel analysis and heat balance should be most helpful in securing approximate results.

In addition to coal, calculations are worked out for wood,

oil, natural gas, coke-oven and blast furnace gases. The importance of an adequate index has been fully realised in making this book a real asset to a technical library.

Wire Drawing and the Cold Working of Steel. By A. T. ADAM. Pp. 160; figs. 67. London: H. F. & G. Witherby, Ltd. 35s.

This is a revised edition of a work that appeared in 1925, the object of which was to create information regarding developments during the past thirty or forty years of which particulars were available only in numerous technical publications. Its intention is to explain the real nature of wire and other cold-worked products, to describe their physical properties, and to show the relationship between these and the treatment of the material.

The appeal of the book will be primarily to the metallurgist and those interested more in product than in manufacture; machinery and plant are dealt with only briefly, attention being mainly concentrated on such matters as the quality and preliminary treatment of the material and the extent of reduction by cold work.

In the edition of the book just published some matter that hardly falls within the limits set by the author has been eliminated, but a new chapter has been added on typical applications of wire.

Wireless Servicing Manual. By W. T. COCKING. Pp. 213; figs. 83. London: Iliffe & Sons, Ltd. Price 5s. net.

Speed and certainty in the location and cure of radio receiver defects can be acquired only by experience. But methods of diagnosis can be taught, and this book sets out in detail those principles of testing upon which servicing depends. It is based largely on symptoms rather than on faults themselves, and should also be a valuable guide to the choice of appropriate testing instruments, an important aspect upon which unbiased information is not easily obtainable.

The treatment is general throughout, so that the methods described will be applicable to future instruments and not confined to present sets or past specimens, acquaintance with basic principles of theory and mode of operation being assumed. Common circuit constants, colour codes, and valve base connections are included in appendices, and a useful index is provided.

Shorter Notices

The fifth edition of "Spons' Electrical Pocket Book" is now available and appears for the first time under joint authorship, Mr. G. W. Stubbings now assisting Mr. W. H. Molesworth in the preparation of this useful little reference book of general electrical information, formulæ and tables for practical engineers.

Since the publication of the previous edition, notable advances have been made, particularly in the fields of transmission and distribution, and the present edition contains a new section on rectifiers, sub-station equipment and automatic protection, as well as a further section on tariffs and the theoretical and practical aspects of power factor correction. All the usual information contained in this pocket book has been revised and brought up-to-date.

"The Human Factor in Industry," Eric Palmer (37 pp.). London: Chapman & Hall. Price 2s.—This little monograph deals with what is broadly called "industrial welfare." It aims at showing that not only do workers benefit from the amenities provided by enlightened employers, but that it actually "pays" the employers to study their workpeople's health, comfort and convenience.

"Electricité sans Algèbre," by A. Soulier. Pp. 462; figs. 164. Paris: Librairie Garnier Frères. Price 15 fr.—This work is designed to give a clear idea of the principles of electricity and magnetism without the use of complicated mathematics.

"Electricity for Boys," by Ellison Hawks. Pp. 387; figs. and illus. London: Ivor Nicholson & Watson, Ltd. Price 7s. 6d.

"Water Heating by Electricity," by J. Russell Hickmott. Pp. 63; figs. and illus. London: Percival Marshall & Co., Ltd. Price 1s. 6d.

"Réseaux Electrique Maillés," by C. Lavanchy. Pp. 134. Paris: Dunod. Price 43 fr.

"Electrical Engineering in Radiology," by L. G. H. Sarsfield. Pp. 284; figs. 199. London: Chapman & Hall, Ltd. Price 25s.

"The Development of the Parsons Steam Turbine," by R. H. Parsons. Pp. 420; figs. 341. London: Constable & Co., Ltd. Price 42s. net.

Parliamentary News (BY OUR SPECIAL REPORTER)

ON April 29th a debate took place in the House of Commons on recommendations of the Ullswater Committee on Broadcasting. Mr. Lees-Smith said that he hoped the Government would accept the recommendation that the minister in charge of broadcasting should be a cabinet minister without heavy departmental duties. He also supported the suggestion for the formation of staff associations, and urged the Government to try to put an end to the advertising programmes from Luxenburg and many other foreign stations which, he said, was a flagrant breach of an international convention.

Mr. Wakefield referred to the criticism of "wireless exchanges," and said that they ought to be very careful before entering on a dictatorship of the air, such as already existed in some foreign countries. Provided that wireless exchanges were under control, they should be allowed to continue to perform the function which they were now performing with satisfaction to their subscribers. There should be, however, a Relay Board which should be in a position to supervise wireless exchanges, and which should be similar in some respects to the Betting Control Board.

Mr. Hulbert pointed out that to nationalise the relay services would be the first step towards nationalising the whole of the manufacture of wireless sets. They did not want the manufacture of any instrument of entertainment to be in the hands of the Government.

Sir Stafford Cripps and Lt.-Col. Moore-Brabazon also raised the question of staff. Captain Plugge, as the person who had initiated the first transmission from an overseas station, asked what objection would be taken to the utilisation of existing facilities to push British trade in foreign countries. There would be no question of any interference with the B.B.C.'s transmissions, since that Corporation had only twelve wavelengths allotted to it and there were some 200 channels in Europe.

Major Tryon, the Postmaster-General, said that the Government would consider all the views put forward. He hoped that on the occasion of a later debate he would be able to speak with greater freedom.

The Grid in Cumberland

On April 29th Mr. W. Roberts asked the Minister of Transport by what percentage the estimated electrical load for 1935 on the transmission system between Carlisle and Egremont was exceeded; what further load the existing system would carry; if the existing system was not yet normally carrying 50 per cent. of its possible load; and if the Central Electricity Board would delay the construction of further circuits from Carlisle to the west of Cumberland until such a percentage was reached.

Mr. Hore-Belisha said that the Central Electricity Board informed him that the load on the transmission system between Carlisle and Egremont was expected to exceed the safe capacity of the existing line in 1937, and that it could not, therefore, delay the construction of further circuits.

Electricity Supply (Meters) Bill

On April 30th, in the House of Lords, this Bill passed through Committee, with the addition of the amendments foreshadowed during the second reading debate.

In the Courts

IN the Chancery Division last Friday Mr. Justice Farwell had before him an action by E. K. Cole, Ltd., of Ekco Works, Southend-on-Sea, against Bush Radio, Ltd., of Wardour Street, London, W., on a motion by the plaintiffs. The action concerned one of the plaintiffs' patents relating to radio receiving apparatus which was not proceeded with, and the present motion was for the sanction of the Court to certain amendments in the specification of the patent.

Mr. J. P. Graham, for the plaintiffs, said that the action had been settled, and the defendants had withdrawn their opposition to the proposed amendments.

Mr. B. Drewe, for the defendants, said that the settlement was on the basis that the action would be discontinued and no claim would be made against the defendants for damages.

His Lordship accordingly made an order staying all proceedings in the action.

Mr. Graham then proceeded to explain the nature of the amendments for which sanction was asked. The idea was to cure two channel interference in superheterodyne receiving sets. It did it very successfully, said Mr. Graham, by separating unwanted incoming signals into two parts, sending each pair down two separate paths with the result that they cancelled each other in the grid. The amendments involved the alteration or substitution of words of the claims in the specification, the chief alteration being made so as to claim for a three-circuit instead of a two-circuit arrangement.

His Lordship said he saw no difficulty in allowing the amendments. An order was made accordingly.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

Engineers' Wages Claim

At a meeting of representatives of the Engineering & Allied Employers' National Federation and of the engineering trade unions held on April 29th, the employers gave a reply to the demand of the unions for an increase of wages of 1½d. an hour for time-workers and an equivalent advance for piece-workers and for revision of the piece-work, night-shift, and coupling-up rates. Mr. A. Ramsay (Director of the Employers' Federation), said that the employers considered the men's application premature, and he suggested the appointment of a joint committee to explore the possibility of agreement. The unions agreed to this proposal and the joint committee is to meet on May 13th. Mr. Ramsay contested the suggestion that wages in the engineering industry were low compared with those in other branches of industry. Having regard to all the circumstances engineering was a well-paid industry even in comparison with the sheltered industries. Referring to the profit-earning capacity of the engineering industry, he said that there was nothing in the records of the various sections for 1935 to show that such a degree of recovery had been achieved in a profit-earning sense that high expectations in relation to the wage situation were justifiable or practicable.

A Lister-Blackstone Agreement

By an agreement which became operative on April 30th Messrs. R. A. Lister & Co., Ltd., of Dursley (Glos), and Messrs. Blackstone & Co., Ltd., of Stamford, will in future co-operate. Under the agreement Lister's have acquired a substantial holding in Blackstone's, and Mr. P. Lister, Mr. R. B. Lister and Mr. A. E. Mellerup join Mr. E. Blackstone, Mr. H. Blackstone and Mr. T. Price on the board of Blackstone's. Mr. P. Lister has been appointed chairman. While the two concerns will continue to operate separately, their association will ensure increased efficiency of production. The policy of the companies will be to co-ordinate the productive resources of their respective plants to the maximum. Both firms have already a substantial export trade, which, it is believed, will be materially increased by their association.

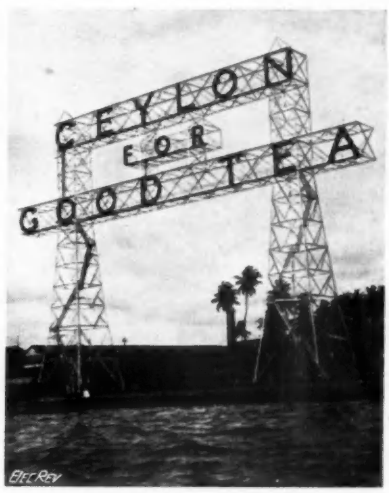
E.D.A. at Charing Cross

The British Electrical Development Association has erected three electric kitchens in the booking hall of Charing Cross "Underground" station. These have been equipped with every electrical device associated with the kitchen, and an impression of the completeness of the installation can be gauged from the accompanying illustrations. The one on the left shows the control panel next to which is a platewarmer and underneath the ingoing hatch with warming plate recess.

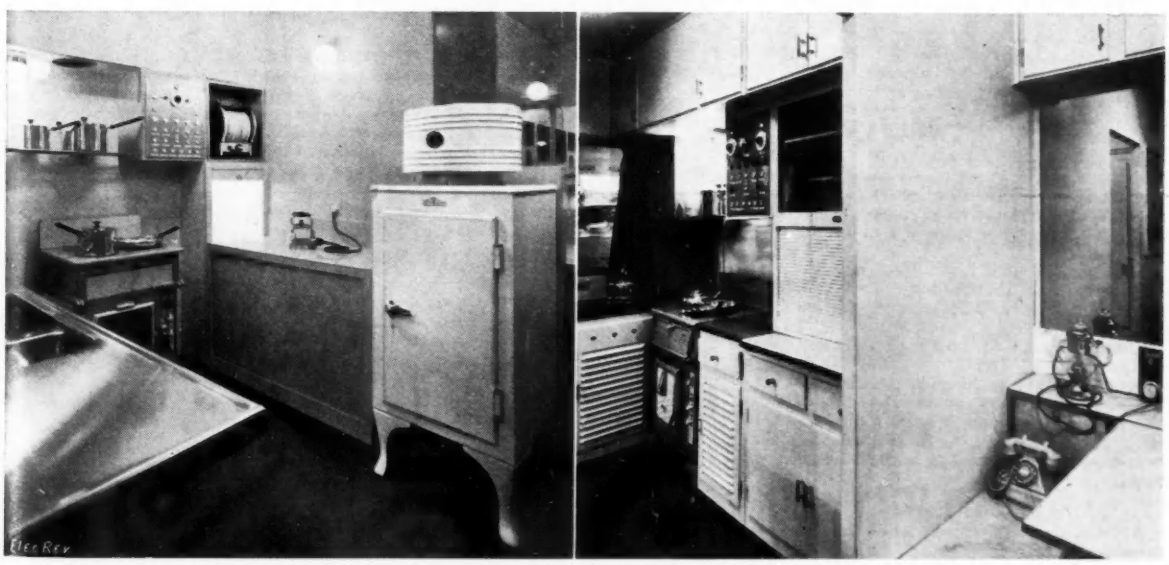
buildings for which orders have been placed with Messrs. Babcock and Wilcox, Ltd., £157,700 for turbo-alternators placed with Messrs. C. A. Parsons and Co., Ltd., and £106,549 for switchgear placed with Messrs. A. Reyrolle and Co., Ltd.

A Large Sky Sign

In 1935 the Ceylon Tea Propaganda Board decided to construct as part of its publicity programme a large illuminated sign at Colombo. The contract for this work was given to Callender's Cable & Construction Co., Ltd., who designed, supplied, and erected the entire structure and also equipped it with neon sign and other cables of their own manufacture. This sign can be seen at night from ships at sea for a distance of twenty-five miles. Consisting chiefly of two lattice towers connected by two transverse members of similar construction the framework had to be sufficiently robust to withstand gale forces and a maximum wind velocity of 100 m.p.h. was catered for in the design calculations. The foundations consist of concrete blocks holding stub angles for the attachment of eight tower legs. The steelwork was shipped from England, where it had been fabricated, in suitable bundles ready for assembly on site. Access to the fronts of the letters for purposes of cleaning and maintenance is possible by means of a travelling cradle carried on a special track running the whole length of the top and bottom girders, while 3-ft. horizontal gangways are situated immediately behind the letters of the sign. The overall height is 160 ft., the overall length 230 ft., and the approximate weight of steelwork in the complete structure is 100 tons. Two sizes of letters are used, being 15 ft. and 10 ft. high respectively.



A large electric sign at Colombo, Ceylon



Two views of the E.D.A. electric kitchens at Charing Cross underground station

In the other picture the large kitchen control panel can be seen to the left, whilst the smaller panel controlling the equipment in the recess is on the right. The display concludes tomorrow (Saturday).

South African Orders for Great Britain

A *Reuter* message from Capetown states that orders totalling £1,072,981 have been placed by the Capetown City Council in connection with a new power station. The more important items are £483,030 for boiler-plant and £107,655 for steel frame

Willing's Press Guide

The up-to-date information which it contains concerning hundreds of technical publications makes "Willing's Press Guide" a useful book for engineers. As with previous issues

the 1936 edition (Willing Service, 2s. 6d. net) includes an alphabetical list of periodicals among which there are year books, diaries and even a number of annual reports. Against the majority there are the day of issue, price, annual subscription, publishing company and telephone number, and in some cases the circulation. There are also a classified list and sections dealing with dominion and colonial publications, foreign publications, recent titular changes and amalgamations, to name only a few.

An Electric Furnace Exhibition at Sheffield

On May 11th an exhibition of electric furnaces manufactured by Messrs. Siemens-Schuckert (Great Britain), Ltd., will be opened at the Sheffield Corporation Electricity Department's premises at Kelham Island, Sheffield. The exhibits will include a duo-muffle furnace for the file industry, a box-furnace with preheating chamber for high-speed steel, an air-circulation tempering furnace with automatic air-flow reversal, an electrode salt-bath furnace, and an industrial water storage heater. All the furnaces will be shown in actual operation, and a special feature of the exhibition will be the demonstrations of the new carbo-neutral salt-bath in conjunction with Imperial Chemical Industries, Ltd. Demonstrations will also be given of the new three-pole welding set with stepless regulation. The exhibition will remain open until May 16th.

A scene from "In the Nick of Time," a comedy which was presented at the Hove Electrical Exhibition

A Vacuum Cleaner Factory Extension

By the opening on April 30th of a new 100,000 sq. ft. extension, Messrs. Hoover, Ltd., have practically doubled the size of their factory at Perivale, Middlesex. The extension has been necessitated by the success of the company's new range of vacuum cleaners, in particular the "Junior," the "Dustette" hand machine, the *de luxe* No. 825, which operates at two speeds for light and heavy work, and the special heavy-duty No. 925 for hotels, theatres and public buildings.

Works Visits

Members of the Association of Supervising Electrical Engineers visited the works of Walsall Conduits, Ltd., West Bromwich, on April 10th. The party was received at Walsall by the directors, and after lunch at the George Hotel made a tour of the company's works.

Members of the Institution of Electrical Engineers visited Oxford on May 2nd. Arrangements for the trip were in the hands of Mr. P. F. Rowell. On arrival at Oxford the visitors proceeded to the Morris assembly plant at Cowley and, after touring the works, they were entertained to lunch at the Morris Clubhouse. Special permission was obtained for the members to visit Merton College, where they inspected the modern electrical installation which was referred to in our issue of April 24th.

Social Events

A dinner was given by Lord Hirst (chairman man managing director of the G.E.C.) and his co-directors, at the Feathers Hotel, Westminster, S.W., as an appreciation of the successes gained by the G.E.C. football teams during the season, the outstanding performance of which was the winning of the West End A.F.A. senior cup. Mr. C. Pinkham presided, and Lord Hirst, in proposing the toast of the Football Section of the G.E.C. Social and Athletic Club, congratulated the members upon their successes in the various leagues. Mr. Pinkham submitted the toast of "The General Electric Co., Ltd.," and Mr. M. J. Railing responded. The toast of "The Visitors" was proposed by Mr. A. G. B. Colyer, hon. general secretary of the Club, to which Mr. E. D. Rees (chairman of the West End A.F.A.) and Mr. H. C. Chapman (chairman of the Westminster A.F.A.) replied.

Synthetic Rubber Research

The *Chemical Trade Journal* reports that the Pirelli concern of Milan, the largest Italian rubber company, is now actively interested in the possibilities of synthetic rubber, and has erected a special research laboratory for work on this material. It is expected that samples of some of the material that will possibly be made will be shown at the forthcoming Milan Sample Fair.

Hove Electrical Exhibition

An electrical exhibition was held last week at the Town Hall, Hove, under the auspices of Hove Corporation Electricity Department. The exhibition was the first of its kind in Hove, although minor displays have been given from time to time at the electricity showrooms. The latest electrical appliances for use in the home, the shop and the office were shown, while special features were soil and greenhouse heating by electricity, high-speed braiding of electric cable, electric vehicles and sewing machines. Besides competitions, interest was added to the exhibition by the presentation of a domestic comedy entitled "In the Nick of Time," which was performed twice daily. There was on view a small model of the prize-winning kitchen design in the E.D.A. all-England competition for architects, while the Hove electrical contractors (members of E.D.A. Circle) had a comprehensive display of domestic electrical apparatus. E.L.M.A. exhibited a home-lighting display piece, architectural lamps and a revolving device showing the popular sizes and types of incandescent and discharge lamps. The E.A.W. was represented by a display similar to the one shown at the National Electrical Convention at Bournemouth, while the Hove Electricity Department had a bureau from which full particulars of the Department's service was given. Other exhibitors were: Booth's Portable Buildings; British Vacuum Cleaner & Engineering Co., Ltd.; Burnley Components, Ltd.; Callender's Cable & Construction Co., Ltd.; Corfield-Sigg, Ltd.; Corporation of Electric Transport, Ltd.; Drake & Gorham Wholesale, Ltd.; English Electric Co., Ltd.; General Electric Co., Ltd.; L. G. Hawkins & Co., Ltd.; Simplex Electric Co., Ltd.; and the Singer Sewing Machine Co., Ltd.

A B.T.H. Sales Conference

On April 30th seventy members of the sales staff of the British Thomson-Houston Co., Ltd., attended the district office annual sales conference held at the company's Willesden works. A full programme of technical papers and discussions was interspersed with tours through the factory for the inspection of the company's latest switchgear products.

Lighting and Vision

Three new publications of the E.L.M.A. Lighting Service Bureau are "The Science of Seeing," "Electric Light in the School," and "Electric Light in the Office." The first (44 pp.) approaches illumination from the health and welfare aspects and discusses the conditions under which the eye can be used without strain. The contrast between natural and artificial illumination (10,000 down to 5 ft. candles) is illustrated diagrammatically to show why eyesight deteriorates. Results derived from the light-sight tester are given in support of the argument that much higher luminous intensities are needed than are usually found and that the requisite values increase with age.

The merits of photo-electric light meters and light-vision

Members of the A.S.E.E. at the works of Walsall Conduits, Ltd.

demonstrators are discussed in relation to their appeal to the layman in enabling him to appraise for himself existing illumination standards and the improvement due to the adoption of higher values. There is a section on the eye and the technical aspects of seeing, among others. The other two booklets, shorter and with more specialised appeals, include suggestions regarding lighting schemes.

The annual Illumination Design Course dinner was held at the Howard Hotel, W.C. It was well attended and the proceedings were of an informal character, the short speeches being interspersed with cabaret items. Mr. C. W. Sully presided in the absence of Mr. S. Y. Fletcher (chairman of the E.L.M.A. Council), who was detained on business in Scotland. Mr. C. Morley New (Electricity Commission), Mr. Fazakerly (for contractors), Mr. Smith (for supply undertakings), and Mr. W. J. Jones (manager, Lighting Service Bureau), also spoke. Mr. Morley New said that since the formation of the Bureau in 1924 shop lighting had increased by 600,000 kW.

Willesden's New Showrooms

Work started last week on the construction of the new £35,000 showrooms which the Willesden Corporation Electricity Department is erecting on a site in the centre of the borough, at the junction of Willesden Lane and Walm Lane.

Electricity in Farming

A campaign to promote the use of milk sterilisers and other farm appliances will be started by the Tamworth District Electric Supply Co., Ltd., when the new showrooms, work upon which will commence soon, are opened towards the end of the year. Investigations have shown that there is a potential demand of half-a-million kWh per annum in the company's territory of 108 square miles for farm sterilisers alone. A special room will be set aside in the new premises for displays of farm electrical appliances. The new showrooms, which will be three storeys high, with provision for adding a fourth when required, will have a frontage of 90 ft. and a depth of 120 ft. on a site in the main street of Tamworth.

Popularising Electric Cooking in Hendon

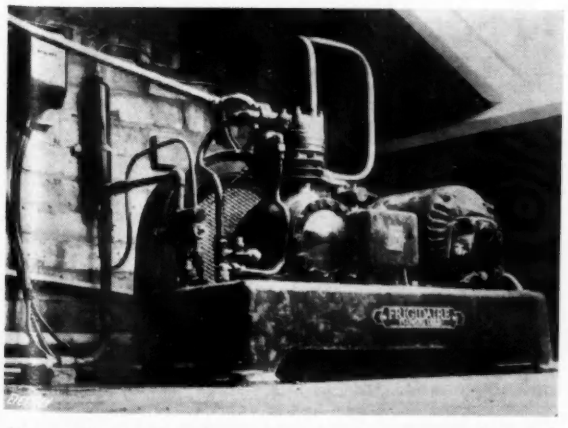
Over three hundred persons witnessed a novel cooking demonstration arranged by the Hendon Electric Supply Co., Ltd., at its head office at 137, Brent Street, Hendon, on April 29th. Mons. X. Marcel Boulestin, *Evening Standard* director of cooking, showed how by means of an electric cooker it was possible to prepare an excellent four-course dinner for four persons in one hour at a total cost of 8s. Hendon already has over a thousand homes equipped with electric cookers and the demonstration is likely to induce others to take advantage of the attractive facilities available.

A New Japanese Company

With a share capital of 2,000,000 yen (£200,000) at par, the Shibaura machinery manufacturing concern and the Tokio Electricity Co., have formed a new company called the Oi Electric Co., which will acquire and work a number of patents for the manufacture of domestic appliances. Its factory will be situated in a suburb of Tokio and offices will be opened in that city and in Osaka.

Making Ice-cream on a Farm

A profitable new line of business for refrigerator manufacturers is opened up by the enterprise of Mrs. E. D. Blowers,



At the Cotlands Wick Jersey Farm the compressor for the refrigerator for storing the ice-cream is installed out of the way in a loft

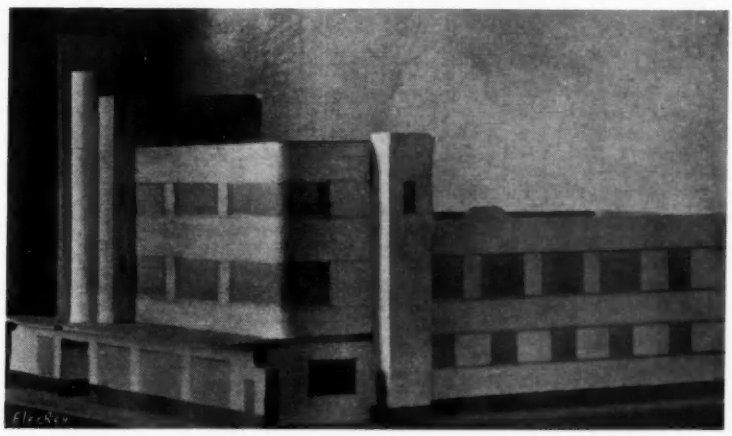
of Cotlands Wick Jersey Farm, London Colney, near St. Albans, in utilising the whole of the milk from a herd of thirty-nine cows for the manufacture of ice-cream. The farm has a frontage on to the main London-Barnet-St. Albans road, and special efforts are made to attract the custom of passers-by. To serve customers in the neighbourhood there is a fleet of pedal tricycles. The ice-cream is made in a 4-gal. mixer (which has already proved too small and will shortly be replaced by a larger model) and then placed to harden in a large double-door refrigerator capable of holding 150 gal. The compressors for the refrigeration equipment, all of which was manufactured by Frigidaire, Ltd., are installed in the roof. Once every day the ice-cream containers, dishes, &c., are sterilised in apparatus supplied by Messrs. Barford and Perkins, Ltd.

Trade Announcements

The Mirrlees Watson Co., Ltd., has received the sole rights for the manufacture and sale in Great Britain, the Dominions, Colonies, and Dependencies, of the Vogel submersible electric pump, as developed by Messrs. Ernst Vogel, Stockerau, Austria. For the time being, the special motors will be made by Messrs. Vogel, and fitted to pumps of Mirrlees make.

British Electric Domestic Appliances, Ltd., has extended the guarantee on its "Aerofrige" refrigerators from one to five years, and in conjunction with this has instituted a hire-purchase scheme ranging from one to five years. This scheme also carries a non-recourse clause for the dealer.

Mr. F. Fradley, electrical engineer, of Cromer Road, Hanley,



A model of Willesden's new electricity showrooms, work on which started last week

Stoke-on-Trent, has removed to new and larger premises at 18a, Market Street, Hanley.

The manufacture and distribution of the products of the business hitherto carried on by Radio Instruments, Ltd. (now winding up voluntarily) have been transferred to Aeronautical & General Instruments, Ltd., who will also manufacture additional components and television apparatus and parts. Mr. J. Joseph continues as managing director, and the staff of the old company has been taken over, including Mr. W. James, who is in technical charge.

Mr. R. W. Lockie has acquired the business of Messrs. P. J. Easton & Son, 35, Queen Victoria Street, E.C.4, together with the representation of Messrs. Shipmans (Sales), Ltd. The business will be continued as before, under the direction of Mr. Lockie, under the same name and at the same address. The new telephone number is City 6243.

Irish Free State Electrical Imports

So far this year there has been a slightly quieter tone in the electrical trade in the Irish Free State, the imports of machinery and allied goods during March last attaining a value of £70,761 as compared with £79,227 in the corresponding month of 1935. Similarly, the imports for the three months to the end of March show a drop from £223,488 to £219,979. The appended table gives the value of imports during the first quarters of 1935 and 1936.

	Jan.–March. 1935.	1936.
	£	£
Electric motors	10,815	14,371
Other electrical machinery	60,203	34,876
Dry batteries and parts	3,933	3,605
Electric lamp bulbs	15,118	15,321
Electric lighting accessories, fittings and parts	17,476	24,761
Electric wires and cables, insulated	23,043	21,781
Telegraph and telephone apparatus	1,165	2,628
Radio receivers, complete	18,111	12,632
Radio-gramophones, complete	1,239	334
Other radio apparatus, fully or partly assembled	1,928	1,405
Radio parts and accessories	19,077	15,807
Other electrical goods and apparatus	51,380	72,458
Totals	£223,488	£210,979

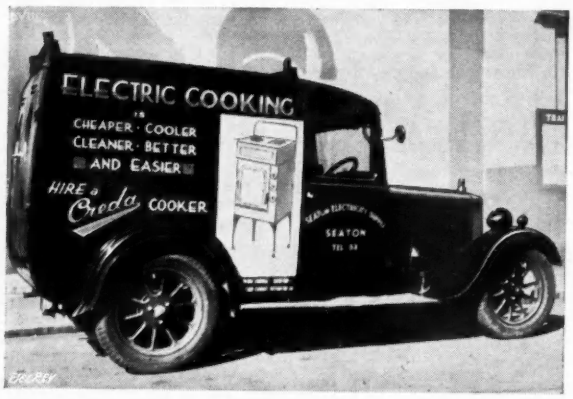
As will be seen, the chief decline in imports has been in electrical machinery, a number of the other items having shown advances.

Calendar

We have received from Messrs. Bruce Peebles & Co., Ltd., a wall calendar for 1936-37. The picture for this year's calendar, which is printed in three colours, is Dunvegan Castle in Skye. At the top of each monthly tear-off sheet are pictures of the company's products.

Another Service Van

The accompanying illustration, sent us by the Simplex Electric Co., Ltd., shows a service van which the Seaton & District Electric Light Co., Ltd., has recently put into service. On one side of the van attention is drawn to "Creda" electric



The Seaton service van

water heaters, while on the other is a reproduction of a "Creda" cooker.

For Sale

Derby Corporation Electricity Department invites offers for the purchase of slot meters.

The Kensington & Knightsbridge Electric Lighting Co., Ltd., has for sale three 6,000 kVA banks of outdoor transformers.

Aberdare Electricity and Transport Department has d.c. motors and meters for sale.

Hull Corporation Electricity Department invites offers for the purchase of one 10,000-kW turbo-alternator.

(See our classified advertisements.)

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances :—

CHEMICALS, ETC.	Price. May 6th.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... . per ton	£36	—
a Ammonia, Muriate (large crystal) ... ,,	£18 10s.	—
a Borax ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£15 10s.	—
a Potash, Chlorate ... ... per lb.	3¾d. to 4¼d.	—
a ,, Perchlorate ... ... ,,	6d.	—
a Shellac ... ... per cwt.	£4 18s.	—
a Sulphur Commercial ... ... per ton	£11	—
a ,, Roll ... ... ,,	£11	—
a Soda Chlorate ... ... per lb.	3½d. to 3¾d.	—
a ,, Crystals... ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d. nett.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil ... ,,	1/3 to 2/9	—
p Babbitts Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£192	£1 inc.
Grade II... ... ... ,,	£132	—
Grade III ... ... ,,	£69	—
c Brass (rolled metal 2" to 12" basis) ... per lb.	7½d.	¼d. inc.
c ,, Tubes (solid drawn) ... ... ,,	9¾d. to 10d.	—
c ,, Wire, basis ... ... ,,	7¾d.	¼d. inc.
c Copper Tubes (solid-drawn) ... ,,	10d.	¼d. inc.
g ,, Bars (best selected) ... per ton	£70	£2 inc.
g ,, Sheet ... ... ,,		
g ,, Rod ... ... ,,		
d ,, (Electrolytic) Bars ... ... ,,	£41 15s.	—
d ,, ,, Wire Rods ... ,,	£47 15s.	—
d ,, ,, H.C. Wire ... per lb.	7¾d.	—
f Ebonite Rod ... ... ,,	1/6 to 2/– plus	—
f ,, Sheet ... ... ,,	1/3 to 1/6 10%	—
n German Silver Wire ... ... ,,	2/5	—
h Gutta-percha, fine ... ... ,,	nom.	—
h India-rubber, Para-fine ... ... ,,	9d.	—
i Iron, Pig (Cleveland No. 3) ... per ton	67/6	—
i ,, Wire galv. No. 1, P.O. Qual.... ,,	£20	—
g Lead, English Pig ... ... ,,	£18	5s. inc.
g Mercury ... ... per bot.	£11/17/6 to £12/7/6	2/6 dec.
e Mica (in original cases) small ... per lb.	9d. to 1/6	—
e ,, ,, medium ... ,,	5/– to 10/–	—
e ,, ,, large ... ,,	10/6 to 17/6 up	—
p Phosphor Bronze, plain castings ... ,,	1/1	—
p ,, ,, drawn bars & rods ,,	11¾d.	—
p ,, ,, rolled strip & sheet ,,	11¼d.	—
p ,, ,, wire ... ... ,,	1/0¾	¼d. dec.
o Platinum ... ... per oz.	£7	—
d Silicium Bronze Wire ... ... per lb.	8½d.	—
g Spelter ... ... per ton	£14 17s. 6d.	10s. dec.
r Steel, Magnet, in bars ... ... per lb.	7½d.	—
g Tin, Block (English) ... ... per ton	£205 10s.	£1 15s. dec.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	3/8	—

Quotations supplied by :—

a G. Boor & Co.
The British Aluminium Co., Ltd.
Thos. Bolton & Sons, Ltd.
Frederick Smith & Co.
e F. Wiggins & Sons.
f India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.
r W. F. Dennis & Co.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in our "Business Notes" under the same heading.

The Industrial Welfare Society

We have received from Mrs. Anthony Eden an appeal for donations to the Industrial Welfare Society. This society was formed eighteen years ago to extend and encourage goodwill in industry. Its president is the Duke of York. In addition to promoting goodwill between masters and men, the Society has organised, and maintains in session, a committee of doctors for advice to employers on matters concerning the health of those engaged in industry.

New Catalogues and Lists

British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2.—A leaflet announcing reduced prices for lamps.

F. C. Heayberd & Co., 10, Finsbury Street, London, E.C.2.—Details of the new type V12/5 battery charger.

Sun Vic Controls, Ltd., 1, Kingsway, London. W.C.2.—Leaflets giving details of vacuum switches, thermostats and temperature controls.

Waite & Son, Ltd., Menin Works, Bond Road, Mitcham.—A comprehensive art catalogue (pp. 64) illustrating in colour lighting fittings and lampshades. A useful feature is a thumb index.

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—A folder setting out the reduced prices of "Osram" lamps.

Siemens & General Electric Railway Signal Co., Ltd., Central House, Kingsway, London, W.C.2.—Details of the "Autoflex" vehicle-actuated system of traffic control.

Consolidated Pneumatic Tool Co., Ltd., 170, Piccadilly, London, W.1.—Particulars in leaflet form of the "Super Safety Balancer" counterpoise.

Wearn's Autoflex Drives, Ltd., 2, Sloane Terrace, London, S.W.1.—A booklet dealing with "Autoflex" drives entitled "Trouble-free Transmission."

Davidson & Co., Ltd., Sirocco Engineering Works, Belfast.—Booklets on "Sirocco Products and the Pottery (Silicosis) Regulations" and "Sirocco Contracts, No. 3."

Bankruptcy Proceedings

Lloyd Electric Lamp Co., 8, Rangoon Street, and late of 4, Lloyds Avenue, E.C.—This firm failed in March, 1935, and on May 1st Tokuichi Otaki, one of the partners, applied to Mr. Registrar Parton, at the London Bankruptcy Court, for an order of discharge. Mr. V. Armstrong, Assistant Receiver, reported that the ranking liabilities amounted to £1,349 and the assets realised £136. The applicant and a partner imported electric lamps from Japan in 1931, under the style of Otaki and Fraser. He withdrew from the partnership at the end of the year, having lost his capital of £1,118. He joined the partnership firm of the Lloyd Electric Lamp Co. in August, 1934. They traded on too narrow a margin of profit to cover the heavy overhead expenses, the failure being further attributed to lack of capital and to the fact that capital promised was not available. The discharge was suspended for six months.

F. Pyle, trading as "F. & E. Pyle," Station Road, Okehampton, wireless engineer.—The public examination in this matter was resumed recently at Plymouth. According to the statement of affairs there were ranking liabilities of £516 with an estimated surplus of assets of £145. Debtor attributed his failure to being supplied with defective wireless sets which he had to make good before selling them, and in respect of which he received no allowance from the manufacturers. He had also to contend with competition from shops dealing in wireless as a side line.

H. E. Haynes, electrical accumulator dealer, Frenshaw Road, New Eltham, and lately of Ormside Street, Old Kent Road, S.E. This debtor attended before Mr. Registrar Kean at the London Bankruptcy Court on April 30th for public examination upon accounts showing total liabilities of £1,096 (ranking £1,046) and assets of £11. He attributed his insolvency to trading on too narrow a margin of profit on cheap car batteries, loss of repair work occasioned by the introduction of cheap batteries and to keen competition. The examination was concluded.

W. M. Pratt and **H. V. Clark** (Magson Clark & Co.), electrical engineers, 165, High Street, Hornchurch, and 10, The Parade, South Benfleet.—Trustee, Mr. C. Latham, 185-8, High Holborn, W.C., released April 7th.

W. J. Richardson (Imperial Radio Stores), 6, Glebeland Street, Merthyr Tydfil.—Trustee, Mr. W. F. Cresswell, Government Buildings, St. Mary's Street, Swansea, Official Receiver, released April 23rd.

C. Coombes, electrical engineer, "Verdley," Portsmouth Road, Milford.—Receiving order made April 28th on a creditor's petition.

E. B. Page, electrical engineer, 10 and 12, John Street, Hyde.—First meeting May 8th at 22, Byrom Street, Manchester. Public examination May 25th at the Town Hall, Ashton-under-Lyne.

J. H. Wood, electrical and wireless engineer, 61, Holborn Hill, Millom.—Trustee, Mr. T. B. Harston, 18, Bank Street, Carlisle, Official Receiver, released April 20th.

S. E. Oliver, electrical and radio engineer, 121, Adnitt Road, Northampton.—Public examination June 5th at the County Hall, Northampton.

E. J. Levermore, electrician, The Cycle Shop, Queen's Road, Weybridge.—First dividend of 5s. in the £, payable May 8th at 29, Russell Square, W.C.

J. W. P. Swale, radio and electrical engineer, 59, Wakefield Road, Moldgreen, Huddersfield.—Receiving order made April 21st on debtor's own petition.

G. H. Moodie, wireless wholesale dealer, 8, Mason Avenue, Huntroyde, Wrexham.—Receiving order made April 23rd on debtor's own petition. First meeting May 12th at St. Peter's Churchyard, The Cross, Chester. Public examination June 18th at the County Hall, Wrexham.

I. Holdsworth (Carlton Manufacturing Co.), wireless dealer, 20B, York Road, Leeds.—Public examination May 19th at the County Court House, Leeds.

H. Rollason, electrical contractor, 61, Stafford Street, Derby.—Receiving order made April 29th on debtor's own petition.

W. Hodge, electrical engineer, 3, Saltash Street, Plymouth.—Last day for receiving proofs for dividend May 15th. Trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.

C. W. Tucker (Wilton Wireless Supplies), 11, Silver Street, Wilton, Salisbury.—Public examination, June 4th, at the Guildhall, Salisbury.

H. D. Smith (Standard Radio and Electrical Co.), 4A, Alpha Road, Surbiton.—Trustee, Mr. C. Latham, 185-8, High Holborn, W.C., released March 27th.

Company Liquidations

Amalgamated Battery Co., Ltd.—Winding up voluntarily. Liquidator, Mr. H. G. N. Lee, 24, John Street, W.C.

Radio Instruments, Ltd.—Winding up voluntarily. Liquidator, Mr. J. Bell, 46, Victoria Street, S.W. (See note on page 683 under "Trade Announcements.")

Radios Electrical, Ltd.—Meeting June 3rd at 185-188, High Holborn, W.C., to receive an account of the winding-up by the liquidator, Mr. C. Latham.

Worcester Electric Traction Co., Ltd.—Meeting June 5th at 88, Kingsway, W.C., to receive an account of the winding-up by the liquidators, Messrs. C. H. Dade and T. H. Underhill.

Southern Electric Free Wiring Co., Ltd.—A declaration of solvency has been filed, and the company is being wound up voluntarily. Liquidator, Mr. H. W. Miles, the secretary.

Sterilex, Ltd.—Winding up voluntarily. Liquidator, Mr. F. R. Vipond, 2, Booth Street, Manchester.

All Wave Radio (Bristol), Ltd.—Winding up voluntarily. Liquidator, Mr. C. H. Eatherington, 16, Whiteladies Road, Bristol.

Private Arrangement

Hollands (Stores), Ltd., Muswell Hill, and Harringay, London, N., dealers in radio and electrical goods, &c.—A private meeting of creditors of the above was held recently at the offices of Messrs. Percy Mason & Co., 64, Gresham Street, London, E.C., when the representative of the Wholesale Fittings Co., Ltd., the principal creditors, was elected to the chair. An approximate statement of affairs was submitted which showed ranking liabilities of £4,160. After allowing £180 for preferential claims the net assets were £2,014, with a deficiency of £2,146 so far as the creditors were concerned. It was stated that some of the larger creditors had already consulted with one of the directors of the company, and it had been hoped to submit a scheme for the continuance of the business. Various suggestions were made, but no workable scheme could be submitted. A resolution was passed requesting the company to go into voluntary liquidation.

Dissolution of Partnership

Milne & Longbottom, electrical engineers, Elm Works, Mere Lane, and 74, Tweedale Street, Rochdale.—The partnership between Messrs. R. Milne and E. Longbottom has been dissolved by reason of the death of Mr. Longbottom. Mr. Milne will attend to debts and carry on the business.

The "K. & K." Jubilee

THE golden jubilee of the Kensington and Knightsbridge Electric Lighting Co., Ltd., was celebrated on Friday last by a dinner which was held at Derry & Toms Restaurant, S.W.

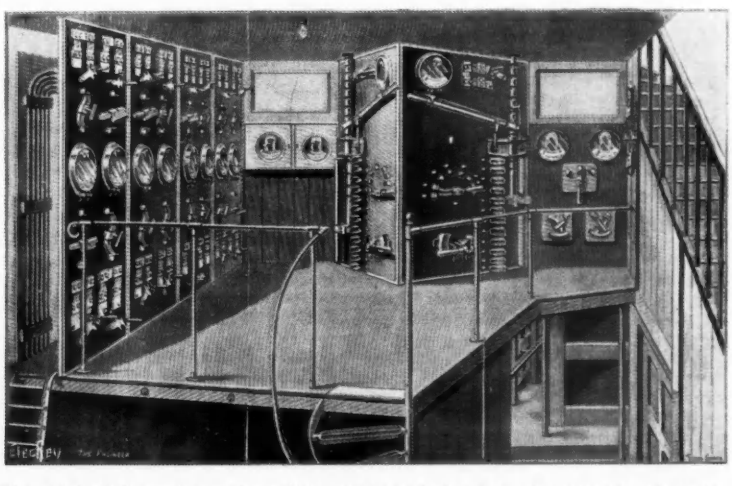
On June 5th, 1886, the company, under the title of the Kensington Court Electric Lighting Co., commenced to give a private supply to an estate then being developed in Kensington Court, a small generating plant having been erected in a shed on the site for supplying low-pressure d.c. The successful outcome of this experiment was the formation in 1888 of the Kensington & Knightsbridge Electric Lighting Co. to supply part of the borough of Kensington, and shortly afterwards the area was extended to include the Knightsbridge section of the City of Westminster. The system adopted was d.c. at 100 V pressure, first, on a two-wire and later a three-wire system. Small generating stations were erected, one at Kensington Court and a little later another at Cheval Place, Knightsbridge. A local station containing storage battery plant was also put into operation in the Queen's Gate area, the storage battery system having always been an integral part of the scheme. The original plant consisted of Babcock & Wilcox boilers and Willans engines directly coupled to Crompton dynamos, and the distributing system employed was bare copper strip strained up between insulators laid in culverts built in the footways.

Development in the early stages was slow but steady, necessitating constant additions to plant and network and, after successful operation for about twelve years, the difficulties of meeting increasing demands from small generating stations incapable of expansion and situated in the midst of residential property became so apparent that a complete reorganisation of the system had to be made. It was decided to build what was then considered a large generating station on a site more adapted for such purposes from which energy could be transmitted at high voltage to the local stations, and the site selected for this purpose was at Wood Lane, about 2½ miles away, where a station was built and equipped with plant generating at 5,000 V, then the highest pressure permitted to be used. H.p. mains from this point were laid to the Kensington Court station and to another local distributing centre established at the rear of the Albert Hall. At these points rotary transforming plant was installed and put into operation, thus augmenting the supply still being given from the local plants. The Wood Lane scheme was shared with a neighbouring undertaking, the Notting Hill Electric Lighting Co., and the first supply was given in 1900.

Satisfactory operation of this system continued for several years and gradually replaced local generation. Increase in demand following the end of the war and security of supply again made it necessary to consider augmenting the Wood Lane system by an h.p. intake from another source. In 1922, therefore, arrangements were made to take energy at the Cheval Place station from the Central Electric Co., operating at Grove Road. The subsequent formation of the London Power Co. in 1925, from which undertaking the company now takes its bulk supply, and the enormous developments that have been made in electricity supply generally since that date, are fresh in the minds of everyone. During recent years the commercial side of the undertaking has been greatly developed, with the result that 98 per cent. of the premises in its area now have an electrical service.

Col. R. E. Crompton, chairman of the company, presided at the Jubilee dinner, and the toast of the "Kensington & Knightsbridge Electric Lighting Co., Ltd.," was proposed by Mr. J. S. Highfield, who said that the most important part of the toast was the coupling with it of the names of Col. Crompton and Mr. G. C. Weston, chief engineer of the company. It was hardly necessary to propose the prosperity of the company considering its present stability. In the fiftieth year of its history another great advance had been made by joining up with other companies into a great group whose intention was to benefit the consumer. The Colonel was chiefly responsible for the foundation of the company, and before that he was driving steam engines out in India. He began his electrical activities when he brought an arc lamp over from Paris; shortly afterwards he started to make dynamos. He might well be called the father, grandfather and great-grandfather of a large number of skilled engineers.

Col. Crompton, in responding, welcomed the visitors, especially the representatives of the associated companies that had joined with them in the co-ordination of electricity supply.



The original Crompton main switchboard and battery regulators at the Queen's Gate station of the Kensington & Knightsbridge E.L. Co.

He was glad that the Kensington Co. was one of the first to take full steps necessary for that. He welcomed all old friends and thanked them for their loyal services.

Mr. G. C. Weston, who also responded, said he was the official with the longest service with the company. When he joined the company it had been in operation for three years, and it had only a small plant of a few hundred kW. In those days knowledge and training were very different from to-day, and those who were engaged in the electricity supply industry then could claim to be among the pioneers who blazed the trail for those who followed. Looking back he felt that their efforts had not been entirely unproductive of results. The company had had a good past and they looked forward to great advances in the future.

In connection with the celebration we are indebted to Messrs. Crompton Parkinson for a reprint from an early Crompton publication, describing the original plant at the Queen's Gate Terrace Mews station and for the accompanying illustration of the Crompton main switchboard and battery regulators at this station.

Electricity Supply

Lighting, Domestic, Power

Banff.—Public Lighting.—A recommendation of the Lighting Committee that an independent lighting engineer should be engaged to advise generally on the question of public street lighting has been approved by the Council, and Mr. Alexander Forbes, inspector of lighting, Aberdeen, has been asked to act in that capacity.

Barking.—Relaying Mains.—The Town Council is to carry out a scheme for the relaying of mains on a portion of the Becontree estate, including the provision of sub-station sites, buildings and equipment, at an estimated cost of £39,580.

Bridlington.—Mains and Services.—The Corporation has received sanction to a loan of £6,000 for mains and services.

Burnley.—New Cables.—To cope with a greatly increased demand for electricity, 6,600-V feeder cables are being laid from Higher Brunshaw to Dyneley Colliery, where a link will be made with a ring main connecting with Burnley. It will also be necessary to lay cables from the electricity works in Burnley to the Holmby Street sub-station and from Colne Road to Harle Syke.

Caldicot.—Inquiry.—Mr. F. Gordon Tucker held a Ministry of Transport inquiry on April 28th into an application by the West Gloucestershire Power Co. for permission to erect overhead cables from Chepstow to Rogiet, Caldicot and Portskewett. The Monmouthshire County Council objected to poles being erected along the main road through Caldicot in view of possible developments in connection with the Severn Bridge. The inspector said that the Ministry of Transport always had the power to review its consent to the erection of overhead lines. If road widening were not likely to be carried out in five years there was no reason why he should not give his consent to the present application.

Canada.—Development in New Brunswick.—A report from our Toronto correspondent states that the Gatineau Power Co., which operates the Grand Falls Hydro Development in New Brunswick, is to construct a 10,000 h.p. turbo-generator unit at Dalhousie to supplement the supply of the Grand Falls to the plant of the New Brunswick International Paper Co.

Douglas.—New Plant.—The Local Government Board recommends the granting of the Douglas Electricity Department's petition to borrow £25,500 for the purchase of additional generating plant and £13,500 for mains, meters, &c. Giving evidence in support of the application, Mr. Bertram Kelly, the Corporation electrical engineer, stated that the maximum demand upon the generating plant was 2,200 kW in 1934 and 3,350 kW in 1935; for 1936 he estimated it would be 4,000 kW, and in 1937 4,500 kW. The present capacity was 7,325 kW, but as they had to keep their largest set in reserve it brought that figure down to 3,575 kW. The proposed extensions (one 3,750 kW turbo-alternator, house service set, switchgear, &c., and house for rectifier plant) would bring the capacity up to 11,075 kW. Last year 526 consumers were connected and 200 cookers were sent out, an increase greater than in any previous year. If, as expected, the demand continued to grow, a new boiler would be necessary by 1938 and a cooling tower by 1940.

Downham.—Domestic Supply.—The London County Council has now decided to install electrical wiring in houses on its Downham estate. The South Metropolitan Electric Light & Power Co., Ltd., is, therefore, extending to Downham, facilities for obtaining electricity for all domestic purposes.

Eastbourne.—Loan.—Sanction to a loan of £25,000 for mains and services has been obtained by the Electricity Committee.

Extensions.—The Electricity Committee is to provide a supply to the Coppice estate at a cost of £2,925 and to the Beechlands estate (£467).

Edinburgh.—Large Extensions at Portobello.—At a meeting of the Public Utilities Committee last week particulars were given of the extensions which are to be carried out at the Portobello power station. They include the following items: Buildings, £74,000; two 120,000-lb. per hr. boilers, including stokers and auxiliaries, £85,000; replacement of two existing stokers, £12,000; one 30,000-kW m.c.r. turbo-alternator set, with condensers and auxiliaries, £95,000; h.p. and l.p. steam, water and circulating pipes, £12,000; e.h.v. and auxiliary switchgear, £8,000; circulating water strainer with pipes, &c., £4,000; circulating pump with valves and pipework, £3,000; coal and ash-handling plant, £2,000. The total cost is £300,000.

Lower Charges.—At the same meeting a report was presented by the engineer and manager recommending certain reductions in the charges for electricity. The cost of the supply to the tramways was reduced from 0.725d. to 0.7d. per kWh, while the alternative lighting rate for shops and offices introduced principally for those consumers whose lamps are used during the day was modified.

Finchley.—Basis of Fixed Charge.—The Electricity Committee has received the Electricity Commissioners' approval of a proposed two-part tariff, but it has decided to take no action regarding their suggestion that the fixed charge should be based on floor area rather than on rateable value.

Mains and Services.—The Electricity Committee has obtained sanction to borrow £30,225 for mains and consumers' services.

Extensions.—A scheme for sub-station and feeder extensions costing £22,107 has been approved.

Halifax.—Change-over.—The Town Council has applied for a loan of £10,000 for apparatus, motors and meters, in connection with the change-over.

Lancaster.—Street Lighting.—The Corporation has decided to re-light the northern section of the A.6 road from the River Lune to the borough boundary, a distance of approximately one mile, states Mr. G. C. Milnes, the borough electrical engineer. The lighting is to comply with British Standard Specification No. 307 (Class D), with a mounting height of 25 ft. to the source of light. Tenders were received from both the Gas and Electricity Departments. For gas the cost of the installation amounted to £1,050 and the annual cost £340; for electricity the respective figures were £669 and £192. The lighting will be carried out with 300 W gasfilled lamps spaced 100 to 115 ft. apart, and will be controlled by "Radiovisors" and time-switches.

London.—St. Pancras.—The installation of additional high- and low-voltage mains from the Ferdinand Place sub-station to Crogsland Road at a cost of £683 and £770 respectively is recommended by the Electricity and Public Lighting Committee. A recommendation has also been made for the improvement in the lighting of York Road at an estimated cost of £1,300 and for the provision of the necessary additional mains costing £1,226. Similar improvements are to be made in various other streets.

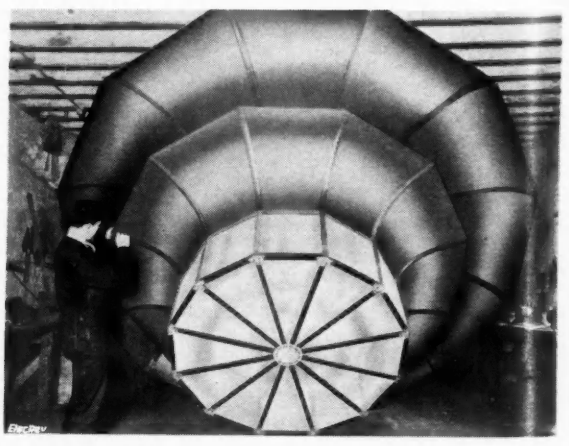
Bermondsey.—The Electricity Committee has obtained sanction to borrow £10,000 for mains and services, £10,000 for wiring, £3,000 for meters, and £2,000 for apparatus.

Fulham.—The Council has arranged for the building of a sub-station to provide a supply to 200 flats in course of erection at West Kensington Court, North End Road.

Manchester.—Sub-station Equipment.—The Electricity Committee is to borrow £11,500 for sub-station equipment.

Newcastle-under-Lyme.—Extension.—As the Clayton road estate is now being developed, the Electricity Committee is recommending the Town Council that a supply of electricity should be made available. Messrs. Callenders Cable & Construction Co., Ltd., have been recommended for the work of carrying out mains extensions.

Northern Ireland.—Belfast.—For the Floral Hall, Belfast, Messrs. Holophane, Ltd., have made a fitting which is 12 ft. 6 in. across and has been specially designed for lighting a circular dome ceiling with intersecting lattice-work. The design of the two top flares, which are illuminated in colour, avoids the loss in efficiency which would occur if indirect lighting were permitted to strike through the open lattice-work across the dome. Seven 500-W concentrating lamps are used in the glass drum at the bottom for white lighting. This combination of white and coloured lighting enables the unit to be used for concerts and public meetings, while the colour-lighting effect is required when the hall is used for dances. The size of the fitting, which is the largest yet made by Holophane, Ltd., is indicated by the accompanying illustration.



The large lighting fitting to be installed in the Floral Hall, Belfast

Plymouth.—Cable Extensions.—The Electricity Committee is to extend cables at a cost of £1,600.

No Hire-Purchase of Refrigerators.—A proposal to include domestic refrigerators in the scheme for the hire-purchase of apparatus has not been entertained by the Electricity Committee.

Illuminations.—Electrical illuminations are to be provided at the Hoe, Tinside and Devonport Park.

Sheffield.—Mains.—The Electricity Committee is to extend mains at a cost of £13,366.

Plant Extensions.—Sanction has been obtained to a loan of £84,515 for buildings and £56,592 for plant at the Neepsend

power station, £80,000 for mains and £105,663 for plant for the extension scheme.

South Africa.—TRANSVAAL.—West Spaarwater, Ltd., is about to proceed with the equipment of the large gold mining properties in the Heidelberg district of the Transvaal, which have been leased from the Government on condition that at least £700,000 is expended on development and equipment. The surface equipment will include ore crushing and treatment works, power station, haulage and transport installations, &c. The company's consulting engineers are Messrs. J. L. van Elyseen, 65, Provident Street, Johannesburg, and J. D. Mackenzie, Transvaal Goldfield Buildings, Fraser Street, Johannesburg.

Stoke-on-Trent.—MAINS EXTENSIONS.—The Electricity Committee has decided to proceed with mains extensions in the various areas, as follows: Northern area, £1,550; central area, £965; south-eastern area, £645; south-western area, £230; and Wolstanton area, £190.

INCREASED DEMAND.—Owing to the general increase in loads in the southern area, application is to be made for sanction to a loan of £5,250 for an additional e.h.v. feeder from the Stoke generating station to the Wesley Street sub-station, Fenton. As the result of an inquiry for an additional supply to an electric kiln at a local pottery, £900 is to be spent on an l.v. distributor along High Street, Longton.

CHANGE-OVER.—A further section of the centre of the town is to be changed over to a.c. at a cost of £6,450.

Switzerland.—ELECTRICAL PROGRESS.—In 1935 the production of electrical power amounted to 5,700 million kWh and consumption was estimated at 1,050 kWh per inhabitant. About 99 per cent. of the houses are wired for electricity, which is stated to be higher than in any other country, being followed by France with 93.6 per cent., Sweden with 84.5 per cent., Germany with 75.3 per cent., Holland with 74.7 per cent., Italy with 56 per cent., and Great Britain with 43.7 per cent.

Todmorden.—OVERHEAD LINES.—Consent has been obtained to the erection of overhead lines at Lower Woodfield Farm and tenders are to be obtained for cables and switchgear.

MAINS AND SERVICES.—Sanction to borrow £10,000 for mains and services has been obtained by the Electricity Committee.

Tunisia.—ELECTRIFICATION.—The electrification of Tunisia is being carried out rapidly, states a *Reuters' Trade Service* message from Paris. There are already 1,080,441 metres of high-voltage and 795,484 metres of low-voltage cable in existence, and when the work now proposed is finished, the Northern and Cape Bon districts will have a distribution system capable of supplying electric light and power to most of the towns and villages.

Uruguay.—ELECTRICITY SCHEME.—It is reported from Montevideo that the Government proposes to establish a large electricity works in the Rio Negro at an estimated cost of over £2,500,000. A German syndicate has submitted a tender in conjunction with the Compania de Obras Publicas, and has offered to grant financial facilities to the Government.

York.—SUPPLY TO STILLINGFLEET.—A supply of electricity to Stillingfleet is to be undertaken by the Electricity Committee.

LOANS FOR EQUIPMENT.—The Electricity Committee has obtained sanction to borrow £3,931 for mains and £1,845 for a sub-station.

Traction

Algeria.—TRAMWAY EXTENSION.—By an agreement just signed between the municipality of Algiers and the Algerian Tramway Company, a sum of 10,000,000 fr. is to be spent in thoroughly modernising the rolling stock of the Algiers tramway system. New articulated trams each with accommodation for 120 passengers are to be built.

Belgium.—EXPRESS SERVICES.—With the introduction of the summer time-tables on May 15th the Belgian National Railways will run 60-65 m.p.h. services between Brussels and Ghent, Bruges, and Ostend with 800 b.h.p. streamlined Diesel-electric trains of three cars.

Doncaster.—SUPPLY TO EDLINGTON.—The Edlington Council has accepted the offer of the Doncaster Collieries Association to supply electricity to houses in the village.

Edinburgh.—POWER SIGNALLING.—The largest power signalling system on the L.N.E.R. is now being installed at the Waverley station. The whole of the signalling will be electrically operated, the existing semaphore method being replaced by modern multi-unit colour-lights, with side lights for close-up indication. The points will be operated by 110-V d.c. motors, and the whole layout will be completely track circuited, involving a total of 121 a.c. circuits. A new feature in signalling work that is to be incorporated is train describing equipment for rapid shunting, designed to expedite operations when arriving trains have to be broken up and remarshalled in a limited time.

France.—MAIN-LINE ELECTRIFICATION.—Since the opening to electric traction of the Montauban-Toulouse-Narbonne main line at the end of last year the P.O.-Midi Railway has put in hand the conversion of the 65-mile extension from Narbonne to the Spanish frontier at Port Bou, and it is expected that the work will be finished by the end of this year. At the same time, the Brive-Montauban section will be opened to electric traction, and trains will then be hauled electrically all the way from Paris to the Spanish frontier, a distance of 604 miles.

PARIS TRAMS TO GO.—A *Central News* message from Paris indicates that plans are being prepared for the abolition of the last tramway line between the Gare de l'Est and Montrouge.

London.—"UNDERGROUND" TIME TABLES.—We have received from the London Passenger Transport Board a copy of its new "Underground Guide" (price 2d.). This contains full time tables for all the Board's railway services during May, including those to outlying districts. There is also a map of the area.

IMPROVED BARKING SERVICE.—For the first time on May 4th a new service of eight trains an hour was run during peak periods between Hammersmith, Baker Street, Liverpool Street, Aldgate East, Whitechapel, East Ham, and Barking. The service will relieve overcrowding on trains between Aldgate East and Barking, and will reduce congestion on Aldgate East platforms. The London, Midland & Scottish Railway Company and the London Passenger Transport Board have co-operated to carry out this development. No part of the Board's railway system is more complex than the train services at Aldgate and Aldgate East. There are five junctions within three-quarters of a mile of Aldgate East Station. Each of these has to deal with intensive train services. Traffic on the Barking line has increased remarkably following the housing and factory development at Dagenham, Becontree, and Upminster. The passengers now number more than 30,000,000 a year. The number of trains which run from District stations over the Barking line in peak periods is increased from twenty-seven to thirty-five an hour. Part of the increased through service has been made possible by diverting four trains an hour from the Metropolitan to the East London line service. More shuttle trains will be worked on the East London line between New Cross and Shoreditch. Further, the exchange facilities at Whitechapel Station between the shuttle trains and the Barking service will be improved by means of interchange subways. The next part of the plan to improve conditions will be the removal of Aldgate East Station about 200 yd. eastward. This work will cost nearly £1,000,000 and will occupy three years.

Lytham St. Annes.—CO-ORDINATING TRANSPORT SERVICES.—The Town Council has approved a recommendation for the co-ordination of Council's transport services and those of the Blackpool Corporation.

Communications

Germany.—RADIO LICENCES.—The number of radio licences in Germany is approaching that in Great Britain. There are now 7,583,840 as compared with 7,617,797 in this country.

Great Britain.—CHEAPER TELEPHONE RATES.—On May 1st the maximum charge for a three-minute call between any two places on the mainland of Great Britain was reduced to 2s. 6d. between 5.0 a.m. and 7.0 p.m., and 1s. at other times.

TELEVISION.—The first television film for transmission from the Alexandra Palace is nearly completed, and it is hoped to begin test programmes on July 1st.

WIRELESS RELAYS.—The Relay Services Association has sent to Members of both Houses of Parliament a statement relating to wireless exchanges and the proposal of the Ullswater Committee that they should be operated by the Post Office. After criticising the Committee's proposal the Association offers the following alternative suggestions: (1) The standard of efficiency of the apparatus and wiring to be subject to the approval of the Postmaster-General. (2) Wireless exchanges to provide an alternative programme service. (3) Wireless exchanges to devote one circuit to the relaying of the entire B.B.C. National programme, on the assumption that all items of national importance and significance, including controversial subjects, are naturally included in the National programme broadcast by the B.B.C. (4) Wireless exchanges to relay on their alternative circuit at their discretion either a selection of B.B.C. Regional programmes or any other suitable programmes, subject to the existing power of veto now enjoyed by the Postmaster-General. (5) Wireless exchanges to be provided with licences available for a period of ten years, to ensure security of tenure, enabling plant, apparatus, and service to be of the highest standard of efficiency.—*The Times.*

India.—BROADCASTING DEVELOPMENTS.—After a comprehensive tour in India Mr. Kirke, the B.B.C. expert who was called out to study the technical problems connected with Indian broadcasting, has prepared two reports, one which he has already submitted to the Indian State Broadcasting Department and the other for the British Broadcasting Corporation. Our Bombay correspondent states that if Mr. Kirke's conclusions are accepted, it appears that the present policy of Government will have to be considerably altered. The policy of the Government, as announced some time ago, is that, after the construction of the high-power broadcasting station in Delhi, it will proceed to equip the Bombay and Calcutta stations with up-to-date plants and to install a similar transmitter in Madras. Mr. Kirke has now recommended that instead of developing the Bombay and Calcutta stations the Government should spend money on giving broadcasting stations to parts of the country which at present have none. The Bombay and Calcutta transmission stations can be received well on receivers of moderate power up to a radius of about thirty miles.

If new 20-kW sets were installed the radius would be extended to eighty miles, but part of this would be wasted, being over the sea. According to Mr. Kirke, the real aim should be to give the people a programme free from atmospheric disturbances. That might best be achieved by stations with a range of about thirty miles. It is further calculated that the best way of providing a stimulus to the development of broadcasting by inducing more people to take licences is to equip the country with small stations. At the same time, there is felt to be a definite need for an all-India station, which might be of 100-kW, or if India's finances permit, up to 500-kW. Mr. Kirke further considers that to launch upon a short-wave scheme in India would not be advisable. He has, however, recommended the early opening of a short-wave transmitting station on an experimental basis. Delhi is considered to be a suitable place for such a station, especially if it worked in collaboration with some universities interested in research work. Mr. Kirke stresses the importance of the cheap receiver in popularising radio. It is hoped that manufacturers in the near future will produce a set selling at between Rs.50 and Rs.100.

London.—NEW ELTHAM TELEPHONE EXCHANGE.—An automatic telephone exchange was brought into operation yesterday at Eltham. It accommodates 2,500 lines, but extensions can be made up to 9,400 lines. The area served is about seven square miles.

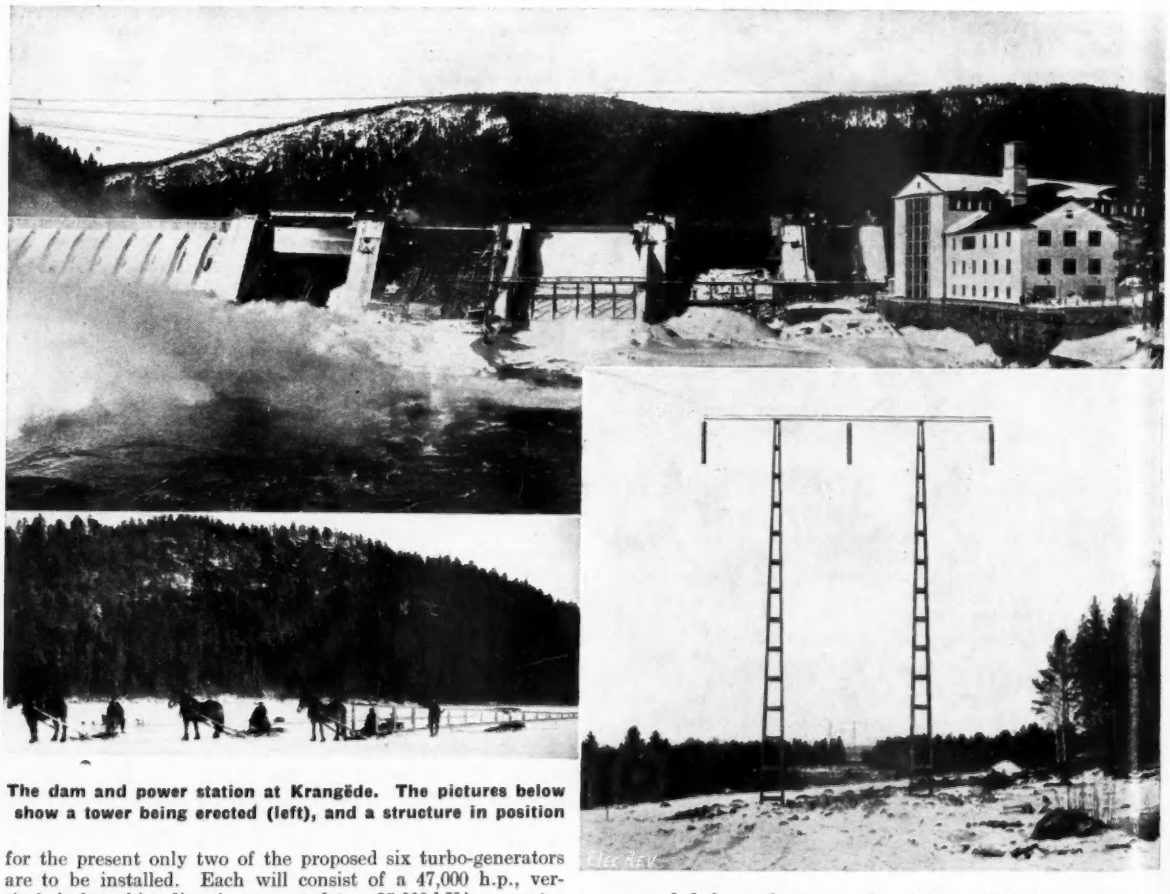
South Africa.—CONTROL OF BROADCASTING.—Mr. Clarkson, the Minister for Public Works, Posts and Telegraphs, moved the second reading of the Broadcasting Bill in the Assembly last week. The Bill provides for the taking over of the control of broadcasting by an African Broadcasting Corporation as from August 1st, and for the establishment of "B" stations, from which sponsored programmes would be given. The Bill embodies all the essential particulars of Sir John Reith's report and draft. The Bill provides for compensation for the present African Broadcasting Company. It was recommended that the company's service should be taken over by a statutory public corporation controlled by a board of six or seven members appointed by the Governor-General in Council for five-year terms, and that transmitters should be erected of sufficient number and power to enable reception by comparatively simple apparatus in all parts of the country.—*Reuter.*

Scotland.—TELEPHONY.—Important telephone developments are being carried out in the Highlands, and the linking of Inverness and Dingwall by underground cable will be finished as soon as a submarine cable is laid across the river Beauly. Later a submarine cable is to be laid across the Caledonian Canal at Muirtown, Inverness.

Large Swedish Power Scheme Nearing Completion

A NEW power station and transmission line for supplying the city of Stockholm and a group of factories in the region of Horndal are to be inaugurated on July 1st. The work has been in progress for five years and the estimated cost of construction is £1,500,000.

Situated on the Krangëde falls of the Indal River, the power station will eventually have a capacity of 210,000 kVA, but for the present only two of the proposed six turbo-generators are to be installed. Each will consist of a 47,000 h.p., vertical shaft turbine directly connected to a 35,000-kVA generator and able to operate under a head of about 196 ft.



The dam and power station at Krangëde. The pictures below show a tower being erected (left), and a structure in position

The power line runs to Horndal, where a transformer station is being installed. From this point it divides, one branch at 220 kV continuing on to Stockholm while three others at 70 kV run to the various factories. The length of the 220-kV line to Horndal is about 210 miles, while the total length to Stockholm (including the section owned by the city of Stockholm) is 310 miles. Of the 70-kV lines radiating from the sub-station at Horndal there will be about 100 miles.

The lines are carried on steel structures which consist of I-beam cross arms supported by two vertical towers, the average length being 63 ft., with a maximum of 70 ft. The towers are sunk about 6 ft. 6 in. into the ground and are fastened on to a footing bed of channel irons to which creosoted timbers are fixed. Each tower weighs about 2,900 lb., and the cross-arm at the top 2,100 lb., giving a total weight for the structure exclusive of footings (750 lb.) of 7,900 lb.

The conductors, which have a total cross section of 255 sq. mm., are of the hollow I-beam core copper "Anaconda" type, suspended from the towers by strings of sixteen insulators. Dead ends are arranged by the use of three strings of eighteen insulators working in parallel. These triple strings are also used for the phase transpositions, which are arranged without the use of special towers. For this purpose, the two ends of the line are dead-ended on either side of a triple string of insulators in mid-span. Loops are then provided from one side of the first string to the opposite side of the second, while the last wire is transposed by a loop running under the three conductors to the other side. At the bottom of each string of insulators a double loop arcing ring is provided to protect the insulators. The flash-over voltage is 665 kV dry and 550 kV wet, with an impulse flash-over voltage of 1,070 kV.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Australia.—MELBOURNE.—June 17th. State Rivers and Water Supply Commission. One 1,250-kW steam turbo-alternator with condenser, &c. (T.Y. 30111.)*

Birmingham.—May 20th. Electric Supply Committee. Cable jointing for the period from July 1st, 1936, to June 30th, 1937. (See this issue.)

Blackpool.—May 12th. Borough Council. Drum-type, fine mesh screen with electric motors, starting gear, electrically driven wash-water pumps and accessories at the Anchorsholme pumping station. Borough engineer, Municipal Buildings (deposit £1).

Bristol.—May 12th. Corporation. 11-kV and l.p. overhead lines in the rural district of Thornbury and Chipping Sodbury, and 6.6-kV and 11-kV transformers. (May 1st.)

Bromley.—May 11th. Town Council. Vehicular-actuated traffic signals at the junction of (a) Croydon Road with Baston Road, and (b) Croydon Road with West Common Road. Borough Engineer's Office, Municipal Buildings (deposit £1).

Burnley.—Electricity Department. E.h.p. cable. (May 1st.)

Burton-upon-Trent.—May 11th. Corporation. H.p. and l.p. cables, switchgear and transformers. (May 1st.)

Cannock.—May 25th. U.D.C. Thirteen miles of 3-phase, 11-kV overhead line and pole mounting transformers and switchgear. (See this issue.)

Cardiff.—May 11th. King Edward VII Welsh National Memorial Association. X-ray equipment at the Adelina Patti Hospital, Penycae, and the Tuberculosis Clinic, Brecon. F. J. Alban, secretary, Memorial Offices, Westgate Street.

Carlisle.—June 3rd. Electricity Committee. Alterations of the existing buildings at the Distribution Depôt and the erection of a large reinforced concrete structure. (See this issue.)

Cheadle and Gatley.—May 21st. U.D.C. Electricity Department. 6.6-kV and medium pressure switchgear and 350-kVA oil-cooled transformer with manually operated on-load tap changer. (See this issue.)

Coventry.—June 6th. Electricity Committee. One 30,000-kW turbo-alternator and auxiliary plant, two 150,000 lb./hr. water-tube boilers, auxiliary plant and buildings, and three ferro-concrete cooling towers and ponds. (May 1st.)

Ealing.—May 15th. Electricity Department. 33-kV and 660-V m.c. switchgear. (See this issue.)

Eccles.—May 18th. Electricity Supply Committee. Twelve months' supply of single-phase a.c. house service and prepayment meters. Borough electrical engineer, Electricity Offices, 1, King Street.

Edinburgh.—June 2nd. Corporation. Two steam generating units for the Portobello generating station. (See this issue.)

Egypt.—CAIRO.—July 1st. Ministry of the Interior. X-ray equipment. (T.Y. 30097.)*

Finchley.—May 25th. Borough Council. 200-kVA transformres. (See this issue.)

Gravesend.—May 23rd. Corporation. L.p. overhead lines in the U.D. of Northfleet. (See this issue.)

Halifax.—June 1st. Light, Heat and Power Committee. Replating of a 300-Ah battery and supply of a battery charging motor generator, switchgear and battery switchboard. (May 1st.)

May 18th. Housing Committee. Various works, including electrical, at forty houses on the Pellon New Road housing estate. D. T. Lloyd Jones, borough engineer, Crossley Street (deposit £2 2s.).

Hastings.—May 28th. Borough Council. One switch and transformer kiosk with oil circuit-breakers. (See this issue.)

Heywood.—May 19th. Electricity Department. Cable, two transformers with "off-load" tap-changing equipment and one six-panel, 6,600-V switchboard. (See this issue.)

Leeds.—May 13th. Housing Committee. Maintenance repairs, including electrical, in groups No. 1 (3,137 dwellings), No. 5 (1,016 dwellings), No. 6 (2,031 dwellings), and No. 7 (1,000 dwellings). R. A. H. Livett, housing director, 26, Great George Street (deposit £2 2s. for each group).

May 18th. Housing Committee. Electrical installation in 1,552 houses on the Gipton estate. (See this issue.)

Lichfield.—May 21st. City Council. Cable, meters, wooden poles, conductors, and street-lighting lamps for the period ending March 31st, 1937. (See this issue.)

London.—BETHNAL GREEN.—May 21st. Borough Council. E.h.p. and l.p. switchgear and transformers. (See this issue.)

May 15th. Electric van. (See this issue.)

Manchester.—May 20th. Electricity Committee. Weldless steel lamp columns and fittings for year ending August 31st, 1937. H. C. Lamb, chief engineer and manager, Electricity Department, Town Hall.

Merton and Morden.—May 15th. U.D.C. Electric-discharge lighting system in Bushey Road, Merton. (May 1st.)

Mexborough.—May 20th. U.D.C. E.h.p. switchgear and 1/3-phase, 10,000/400-V transformer. (See this issue.)

Newark-on-Trent.—May 25th. Borough Council. One steel switch and transformer kiosk and 150-kVA transformer. (May 1st.)

New Zealand.—WELLINGTON.—June 2nd. Public Works Department. One motor-generator set and one copper-oxide rectifier unit. (T.Y. 30096.)*

June 15th. Government Railways Administration. Machine tools and electric overhead travelling crane. (T.Y. 5788.)*

Northern Ireland.—BELFAST.—May 30th. Electricity Committee. 30,000-kW turbo-alternator plant with auxiliaries and pipework. (See this issue.)

Norwich.—Corporation. Boiler feed and circulating water pumps, &c., and 6,600-V 3-phase switchgear, &c. (See this issue.)

Portsmouth.—May 19th. Electricity Undertaking. Reconstruction of the existing 6,600-V metal-clad switchgear at the power station to increase its rupturing capacity. (April 24th.) Lining and repairing existing steel bunkers at the generating station, Gunwharf Road. (See this issue.)

Rosehearty (ABERDEENSHIRE).—May 12th. Town Council. Electric lighting of the streets of the borough and thirty-five houses. Jenkins and Marr, 16, Bridge Street, Aberdeen.

St. Helens.—May 11th. Corporation. Seven double-deck, four-wheel type trolley-buses. A. A. Jackson, general manager and engineer, Transport Offices, Hall Street.

Sheffield.—May 11th. Electricity Committee. Steam shunting locomotive and natural draught concrete cooling towers. (April 24th.)

June 1st. Two water-tube h.p. steam boilers with associated equipment for the Blackburn Meadows generating station. (May 1st.)

May 11th. Transport Department. Various supplies, including traction lamps, cables, armature coils and commutators. A. R. Fearnley, general manager, Division Street.

Sleaford.—May 19th. U.D.C. L.p. cables and a.c. and d.c. meters for twelve months and l.p. distribution mains and equipment. (See this issue.)

Slough.—May 27th. U.D.C. Two groups of pumping plant with motors, pipe connections, valves, switchgear, &c., and appurtenant works at two pumping stations. G. B. Kershaw & Keufman, 9, Victoria Street, London, S.W.1 (deposit £5).

South Africa.—PRETORIA.—May 29th. Union Tender and Supplies Board. Galvanised iron telegraph arms, pole fittings, &c. (T.Y. 40037.)*

JOHANNESBURG.—May 26th. Railways and Harbours Administration. Thirteen 4-ton level luffing electrically driven portal jib cranes. (T.Y. 30012.)*

Staffordshire.—May 19th. Potteries Water Board. Two sets of electrically operated rotary pumps with electric control, cables, &c. P. Wilkinson, engineer to the Board, Albion Street, Hanley (deposit £5).

Tottenham.—May 25th. Education Committee. Electrical installation in the Downhills, Belmont, Parkhurst and Crowland Road elementary schools. (See this issue.)

Wallasey.—May 25th. Borough Council. Seven switch pillars for a single-phase, 50-cycle, 2,200-V system. (May 1st.) H.p. and l.p. p.i. cables and house service meters during year ending June 30th, 1937. (See this issue.)

Walsall.—May 14th. Electric Supply Department. One 8-cwt. electric service van. (May 1st.)

May 18th. Walsall and West Bromwich (Barr Colony) Joint Board. Electrical installations at extensions of the Barr Colony. Edwards and Shaw, 105, Colmore Road, Birmingham, 3 (deposit £3 3s.).

Walton and Weybridge.—May 20th. U.D.C. Electricity Department. Twelve months' supply of l.p., p.i., l.c. and s.t. armoured cables. (See this issue.)

West Riding.—May 11th. Mental Hospitals Board. Wiring for electric lighting in the extension to nurses' residence, Storthes Hall Mental Hospital, Kirkburton. W. E. H. Burton, architect and engineer to the Board, Mental Hospital, Wakefield (deposit £2 2s. to clerk of the Board, Victoria Chambers, Wood Street, Wakefield).

Weymouth and Melcombe Regis.—May 11th. Town Council. Automatically operated electrically driven pumping plant and incidental works at pumping stations. M. G. & R. W. Weeks, 75, Victoria Street, London, S.W.1 (deposit £5 5s.).

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* Further particulars from the Department of Overseas Trade (Inquiry Room), 36, Old Queen Street, London, S.W.1.

Contracts Closed

Barking.—Electricity Committee. Accepted. Switchboard for the College (£129).—Ferguson, Pailin.

Brierley Hill.—U.D.C. Accepted. Public lighting of Dudley Fields and Queen Street housing estates.—Midland Electric Corporation for Power Distribution, Ltd.

Durham.—County Education Committee. Accepted. Installation of electricity at the Easington Colliery New Council school (£315).—R. Robson, Willington.

County Health Committee. Accepted. X-ray plant at the Hollywood Hall Sanatorium (£750).—Watson & Son.

Edinburgh.—Corporation. Accepted. Two electric passenger lifts at the Western General hospital.—Etchells, Congdon and Muir, Ltd.

Glasgow.—Housing Committee. Accepted. Electrical installation at 141 houses at the Kelvindale Road No. 2 estate (£596).—A. & C. Edelman.

Libraries Committee. Accepted. Electrical installation at Maryhill District Library (£222).—Cross & McIlwam.

Police Committee. Accepted. Electrical installation at the Govan Poilce headquarters (£374).—Cross & McIlwam.

Public Assistance Committee. Accepted. Cables for the Lennox Castle Institution (£1,426).—Henley's.

Sub-Committee of the Electricity Committee. Accepted. Six electrically propelled vehicles (£2,934).—Electricars, Ltd. Six batteries (less allowance for old batteries) (£1,079).—Tudor Accumulator Co.

Kirkcaldy.—Electrical work at King Street housing estate (£2,234).—A. & C. Edelman, Ltd., Glasgow.

London.—WESTMINSTER.—Works Committee. Accepted. Neon lighting and signs at Caxton Hall (£235).—British Electric Installations Co.

FULHAM.—Electricity and Lighting Committee. E.h.p. switchgear required at the Barclay Road sub-station :—

	£		£
Ferguson Pailin, Ltd. Accepted	**4,982**	British Thomson-Houston Co. ...	5,225
English Electric Co.	5,081	A. Reyrolle & Co.	5,539
Metropolitan-Vickers Elecl. Co....	5,184		

Recommended. Extensions of the generating station: Boiler-house auxiliary plant including air fans, flue gas ducts, boiler control panels, transformers, motor control gear, &c., for boilers Nos. 7 and 8 (£30,028).—J. Howden & Co., Ltd. Auxiliary switchgear and cables (£10,500).—Malcolm & Allen (London), Ltd.

ST. PANCRAS.—Contracts and Stores Committee. Recommended. Two 1,500-kVA transformers for the new Town Hall sub-station:

	Price each. £		Price each. £
British Electric Transformer Co....	{661 666	Metropolitan Vickers Electrical Co.	773
		Brush Electrical Engineering Co.	782
Electric Construction Co., Ltd. ...	665	Yorkshire Electric Transformer Co.	785
Fuller Electrical & Manufg. Co. ...	666	Ferranti, Ltd.	799
General Electric Co. Recommended	**666**	British Thomson-Houston Co. ...	838
Hackbridge Electric Construction Co.	755	C. A. Parsons & Co.	866
		Bruce, Peebles & Co.	890

Recommended. Existing twelve-month contract for supply of meters to be extended until July 31st, 1936.—Chamberlain & Hookham, Ltd.

Manchester.—Rivers Committee. Accepted. Overhaul and extension of internal telephone system at Davyhulme sewage works.—L. E. Wilson & Co.

Electricity Committee. Accepted. 10,000-kVA static transformer at the Denton (West) sub-station.—Met.-Vick. 10,000-kVA static transformer at the Droylsden (East) sub-station.—Ferranti, Ltd. 400-V, three-phase a.c. switchgear at the Manchester Royal Infirmary sub-station.—Parmiter, Hope & Sugden. 33,000-V feeder cables for Stuart Street station to Denton West sub-station and from Dickinson Street to High Street sub-stations.—Callender's. Reactors for the Stuart Street power station.—Hackbridge Electric Construction Co. Fire extinguishing equipment for the Stuart Street power station and Dickinson Street and Oldham Road "B" sub-stations.—Walter Kidde Co.

Maybole (AYRSHIRE).—Town Council. Accepted. Electrical work at thirty-six houses to be erected on the Lorne site.—Darroch & Espie, Glasgow.

Middlesex.—Health Committee. Metal-clad switchboard for Harefield Sanatorium:

	£		£
Standard Switchgear	1,610	Metropolitan-Vickers Electl. Co.	2,168
Crompton Parkinson	1,718	Electric Construction Co. ...	2,205
T. Clarke & Co. Accepted ...	**1,730**	Erskine Heap & Co.	2,208
General Electric Co.	1,734	Ferguson Pailin	2,234
British Thomson-Houston Co. ...	1,808	New Switchgear Construction Co.	2,494
Brookhirst Switchgear	1,822	Switchgear & Cowans	3,040
Johnson & Phillips	1,830	English Electric Co.	3,052
M. & C. Switchgear	2,035	A. Reyrolle & Co.	3,653

Cooling apparatus for the mortuary at West Middlesex Hospital:

	£		£
Coldair, Ltd. Recommended ...	**489**	British Thomson-Houston Co. ...	535
Superfrigor, Ltd.	498	British Automatic Refrigerators Ltd.	633
J. & E. Hall	506		

Newcastle-under-Lyme. — Electricity Committee. Recommended. Mains extensions for the Clayton Road estate.—Callender's. Overhead wiring and services in 112 houses and two shops.—F. Hancock. Overhead wiring and services in forty-seven houses and two shops.—J. Bagguley & Son. Electrical wiring in 170 houses and two shops.—Barnett and Colclough.

Plymouth.—Health Committee. Accepted. X-ray equipment (£495).—Victor X-Ray Corporation, Ltd.

Electricity Committee. Accepted. Oil circuit-breaker (£147).—G.E.C.

Salford.—Electricity Committee. Recommended. Renewal of battery plates at power station (£1,900).—Chloride Electrical Storage Co.

Sheffield.—Electricity Committee. Accepted. Modification of two switches (£455).—G.E.C.

Forthcoming Events

Institution of Electrical Engineers (*Irish Centre*).—Monday, May 11th. Hibernian Hotel, Dublin. Annual conversazione.

Hampshire Sub-Centre.—Wednesday, May 13th. University College, Southampton. 7.30 p.m. "Refrigeration and Thermal Insulation."

Mersey and North Wales (Liverpool) Centre.—Wednesday, May 13th. Royal Liverpool Golf Club, Hoylake. Annual Benevolent Fund golf competition.

Transmission Section.—Wednesday, May 13th. Institution, London, W.C.2. 6 p.m. "The Electric Supply System in Berlin." Mr. M. W. H. Davies. Friday, May 15th. Summer visit.

London Students' Section.—Friday, May 15th. Institution, London, W.C.2. 7 p.m. Annual general meeting.

Birmingham Electric Club.—Friday, May 8th. Annual outing to Prescot. Visit to the works of the B.I. Cables, Ltd.

Institution of Mechanical Engineers.—Friday, May 8th. Institution, London, S.W.1. 7 p.m. Informal meeting. "Power Transmission by Belts." To be introduced by Mr. J. Hornsby.

Royal Institution.—Friday, May 8th. Institution, London, W.1. 9 p.m. "The Electric Properties of Crystals." Sir Wm. Bragg.

Illuminating Engineering Society.—Tuesday, May 12th. Institution of Mechanical Engineers, London, S.W.1. 7 p.m. Annual meeting. 7.15 p.m. "Some Aspects of the Question of Reflection from Road Surfaces and Notes on the Development of Lighting in France." Dr. Merry Cohu.

Electrical Association for Women.—Wednesday, May 13th. to Friday, May 15th. Annual conference and ball. Annual general meeting and luncheon will be held on Thursday, May 14th. and the ball on Friday, May 15th.

British Institute of Radiology.—Thursday, May 14th. Reid-Knox Hall, London. 6.30 p.m. Annual general meeting.

Physical Society.—Friday, May 15th. Imperial College of Science and Technology, London, S.W.7. 5 p.m. Guthrie Lecture by Prof. F. A. Lindemann.

Electrical Power Engineers' Association. (*North West England Section*).—Saturday, May 16th. Municipal Buildings, Southport. 3 p.m. Joint general meeting. Address by Mr. H. S. Smith.

Notes

E.A.W. Conference Arrangements

Further information is now available regarding the eleventh annual conference of the Electrical Association for Women which is being held in London from May 13th to 16th. The speakers at the luncheon to be held on Thursday, May 14th, at the Park Lane Hotel will be Mr. St. John Ervine, Mrs. M. A. Hamilton (a governor of the B.B.C.), Miss Violet Markham (chairman of the Ministry of Labour Central Committee on Women's Training), and Mr. R. P. Sloan, member of the Central Electricity Board. At the annual general meeting preceding the luncheon the chairman is to be the Dowager Lady Swaythling, vice-president of the Association, who will propose a resolution from the National Executive Committee urging that the status of domestic workers should be raised. Lady Watson, president of the Yorkshire County Organisation, is taking the chair for Mr. C. C. Paterson when he delivers his address on "The Liberation of the Electron" at the Institution of Electrical Engineers on the same evening.

"Too Old at . . ."

Appalling as are the regularly published statistics of unemployed these take no account of a large number of men whose position is worse than that of the people coming within the scope of the Insurance Acts. They are the professional men who for one reason or another find themselves without work and means of existence. In a large proportion of such cases their age tells against them, and it is to meet this situation that the "Over Forty-fives" Association, Ltd., has been formed. This Association is embarking upon a wide range of activities, including the purchase, building, reconditioning and letting of working class flats (through a subsidiary concern); electrical installation work; the provision of lecturers and teachers for schools and private courses; a motor driving school and car-hire service; insurance brokerage; and the development of roadside catering and guest houses. To do all this requires capital, and the Association has made an appeal for subscriptions for shares—not as a charity but as an investment. Full particulars of the scheme can be obtained from the hon. secretary, 39a, Chesham Street, Eaton Square, London, S.W.1.

Proposed New I.E.S. Centres

Some years ago the Illuminating Engineering Society established a local centre in the north-western area, with headquarters at Manchester. Similar action is now being taken in Glasgow and Dublin where a nucleus of local members of the Society already exists. The acting honorary secretaries are Mr. J. Creagh, 1, Ashbrook Villas, Ashbrook House, Sallymount Avenue, Ranelagh, Dublin, and Mr. T. Catten, Lighting Service Bureau of Scotland, 29, St. Vincent Place, Glasgow.

The E.I.B.A. Summer Cruise

Readers who propose to take part in the cruise to Madeira, &c., should send their bookings to Mr. A. H. Seabrook, Executive Officer, E.I.B.A., 6, Southampton Street, Holborn, W.C.1, by May 13th at the latest.

"Characteristics of Brushes"

In the article on this subject published in our last issue the descriptions of two diagrams were transposed. Fig. 1 should have read "Brush pressures" and Fig. 2 "Brush characteristics," instead of in the reverse order.

Appointments Vacant

Assistant electrical engineer for Kirkcudbright Electricity Department.

Electrical assistant for the Port of Bristol Authority.

Lady demonstrator and showroom assistant and showroom salesman for Luton Corporation.

Switchgear engineer for Derby Electricity Department.

Lady demonstrator and showroom assistant for the Tilbury electricity undertaking of the Thurrock U.D.C.

Three sales engineers for the London Associated Electricity Undertakings, Ltd.

Bethnal Green Electricity Department has a number of vacancies.

Deputy chief engineer and manager for the Electricity Board of Ceylon.

(See our classified advertisements.)

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

Bakelite pear switch with rubber ring protector.
MAGIC MAID automatic toaster.
ALCOSA motor-driven forge
SUNLITE batteries.

Readers should enclose stamped addressed envelopes when making their inquiries.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. John Wilson, O.B.E., M.I.E.E., who has been appointed general manager of the Entre Rios and Nord Este Argentino Railways, is a native of Coatbridge, Lanark, and was technically educated at the Glasgow and West of Scotland Technical College. He gained experience as an electrical engineer with a number of electricity supply authorities and the Glasgow Corporation Tramways. In 1914 he became resident engineer for the construction of the electrification of the Buenos Aires Western Railway, which was held up by the War. Mr. Wilson returned to England and was given a commission as captain in the I.W.D. and later took charge of an Admiralty research station. When the work of electrifying the B.A. Western Railway was resumed in 1919 Mr. Wilson returned to Argentina; the electric service was inaugurated in 1923. He remained chief electrical engineer of the railway until 1930, when he was appointed traffic and transport manager. In 1933 he went to the Southern and Western Railways as traffic superintendent, a post from which he retired to take up his new appointment. Mr. Wilson has been prominent in engineering association activities in Argentina, having been chairman of the local centre of the Institution of Electrical Engineers.

Mr. C. A. Roberts, who has retired from the position of technical general manager of the Buenos Aires Great Southern and Western Railway, was engaged in the electrification of the London "Underground" railways, and was also for a time with Messrs. J. I. Thornycroft & Co., assisting in the construction and testing of the first turbines built by that company.

Mr. F. H. Francis, deputy electrical engineer at Oxford, who has retired after being connected with the undertaking for forty-five years, has been presented by the employés with an electric clock and an all-mains wireless set. Mr. Francis commenced with the undertaking on October 26th, 1890, and he was chief engineer with the Oxford Electric Co., Ltd., from 1901 until the end of 1931, when the inner area of the undertaking was taken over by the Corporation, and he then became deputy electrical engineer.

Mr. and Mrs. A. Sargent, of Prospect House, Kilburn, Derby, have celebrated their silver wedding, and have been presented with an inscribed silver salver and illuminated parchment by Mr. Sargent's colleagues at the Derby works of the Macintosh Cable Co., Ltd., where he holds the position of works manager.

Miss N. Johnston, a member of the Inverness electrictiy staff and of the committee of the Inverness branch of the Electrical Association for Women, was presented with gifts on the occasion of her approaching marriage. The presentation was made by Mrs. Mackenzie, wife of the provost.

Mr. W. F. Long, M.I.E.E., has retired from the position of general manager of the Cape Electric Tramways, Ltd., a position which he has held since 1916. From 1902 to 1916 he was city electrical engineer of Capetown. He is not entirely severing his connection with the company, however, as he will act as a consultant to Mr. A. C. Fenwick, the assistant general manager, who succeeds him.

Mr. A. C. Fenwick, formerly rolling stock superintendent of Dundee Corporation Transport Department, who has been appointed general manager of the Cape Electric Tramways to succeed Mr. Long, was employed in the Dundee Transport Department from 1911 to 1929, when he was appointed general manager and engineer to the Bury (Lancs) Corporation Transport Department. In 1932 he left Bury to take up the appointment in South Africa of assistant general manager of the Cape Electric Tramways.

Lord Eustace Percy has been elected president of the Royal Institution for the ensuing year.

Mr. J. W. Spark, city electrical engineer of Bath, has been nominated for the chairmanship of the Western Centre of the Institution of Electrical Engineers for the session 1936-37.

Dr. Frank B. Jewett, president of the Bell Telephone Laboratories, has been awarded the Franklin Gold Medal by the Franklin Institute of Philadelphia in recognition of his many important contributions to the art of telephony. About a year ago Dr. Jewett received the Faraday Medal from the Institution of Electrical Engineers, London, for his telephone work.

Mr. A. F. Hutchen, D.L.C. (Hons.), Grad.I.E.E., has left the staff of Kettering Urban District Council's Electricity Department on his appointment to the position of assistant works manager at the *News-Chronicle* and *Star* Office, London.

Messrs. Handcock and Dykes announce that they have now taken into partnership **Mr. C. W. Smith,** M.I.E.E., their chief assistant, who has been in the service of the firm for over thirty-one years.

Mr. W. Reid has been appointed as engineer-assistant to Mr. J. Lawson, general engineer and manager of the Hull Corporation Transport Department, at a salary of £600 per annum. Mr. Reid is at present rolling-stock maintenance engineer to the Edinburgh Corporation.

Mr. L. F. Fogarty, M.I.E.E., managing director of the Zenith Electric Co., Ltd., has been re-elected to the Ruislip-Northwood Urban District Council, and, at the annual meeting, was appointed chairman of the Finance Committee and also of the Staff and Air Raid Precautions Committees, as well as the Council's representative on the North-West Middlesex (No. 6) Area Committee of the London and Home Counties Joint Electricity Authority.

The Minister of Transport has been informed by the Appointing Trustees acting under the provisions of Section 1 of the London Passenger Transport Act, 1933, that they have appointed **Sir Edward Holland** and **Sir Henry Maybury** to be members of the London Passenger Transport Board for a further period of three years on the expiration of their present appointments on May 17th.

Obituary

Mr. J. H. Greenhill.—The death occurred at Southampton on April 26th, at the age of ninety years, of Mr. John Haytor Greenhill, a well-known Belfast citizen, and once of the firm of Greenhill & Craig of that city. Leaving his father's tanning business he turned his attention to engineering, and in the year 1880 he entered the then infant electrical engineering business in association with Col. R. E. Crompton. We understand that Mr. Greenhill was the first to introduce incandescent electric lighting into Ireland. In 1881 and 1882 he installed the new illuminant in various Irish factories, in which branch of work he did an expanding business. He was interested in many scientific inventions, including the telephone and the phonograph, and gave popular lectures and demonstrations in the early days. Mr. Greenhill sold his Belfast business in 1898 and retired to Southampton. He was an enthusiastic musician. He was twice married; his second wife died last year, and he is survived by two daughters of his first marriage.

Sir Philip Nash.—We regret to record the death of Sir Philip Nash, which occurred on May 1st at his London home in his sixty-first year following pneumonia. Sir Philip entered the locomotive department of the Great Northern Railway in 1897, where he remained for two years. For the next fifteen years he was in the service of the East Indian Railway, returning to this country at the beginning of the war. During the period of hostilities he was successively Director of National Filling Factories (Ministry of Munitions), Deputy Director of Transportation (B.E.F.) and Inspector-General of that department. In 1917 he was made C.B., was created K.C.M.G. in 1918, and two years later retired from the Army with the honorary rank of major-general. Upon his return to commercial life he was appointed chairman of the Metropolitan-Vickers Electrical Co., Ltd., in 1922, which position he resigned in 1931, retaining a seat on the board. He was elected to the Council of B.E.A.M.A. in 1931, and in the following year he became a vice-president of the Radio Manufacturers' Association, and was elected a member of the Royal Institution. He was also on the board of Associated Electrical Industries, Ltd., from which he resigned in April, 1932, and was chairman of Messrs. W. T. Glover & Co., Ltd. He joined the board of Great Universal Stores, Ltd., in December, 1932, and was a member of the Distributors' and Shippers' Sub-Committee set up by the Coastal Trade Development Council.

[*Elliott & Fry*
The late Sir Philip Nash

A funeral service was held on Tuesday last at All Saints' Church, Ennismore Gardens, at which a large number of representatives of the electrical industry were present.

Monsieur J. F. Cellerier.—The death occurred recently in Paris at the age of sixty-five of Monsieur Jean Fernand Cellerier, the director of the testing laboratory at the French Conservatoire National des Arts et Metiers.

Signor A. Marconi.—The death occurred on April 24th in London of Signor Alfonso Marconi, brother of the Marchese Marconi, whom he assisted in his early experiments in connection with wireless communication.

Mr. G. Phillips, who died on May 2nd, was in business as an electrical engineer at 17, Chatsworth Road, Worthing. He was formerly associated with Messrs. Page & Miles, at their Worthing branch, and was a partner in the firm of Phillips & Dart, Ltd., electrical engineers, Worthing.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Heatrae, Ltd.—Public company. Registered April 29th. Nominal capital, £100,000. Objects: To acquire the business of electrical engineers and manufacturers carried on by Heatrae, Ltd. (now in liquidation) at Norwich, and to carry on the business of manufacturers of electrical apparatus and equipment, heating, lighting, motor boat, marine, laundry, water, oxy-acetylene welding and specialist engineers, &c. The directors are:—Engineer Comdr. F. L. Newhouse, R.N. (retd.), The Manor House, Thorpe St. Andrew, Norwich, C. H. Smith, A.M.I.E.E., 37, Portsdown Road, Maida Vale, W.9, and E. I. Watson, LL.D., 3, Mile End Road, Norwich. Registered office: Heatrae Works, St. George Street, Norwich.

George Clark (1936), Ltd.—Private company. Registered April 30th. Nominal capital, £75,000. Objects: To acquire the Southwick Engine Works, Southwick-on-Wear, belonging to George Clark, Ltd., and part of the undertaking and assets connected therewith, together with the business carried on there by the said company, and all or any of the liabilities, and to carry on the business of mechanical, electrical and general engineers, builders, and manufacturers of engines, motors, machinery, boilers, turbines, furnaces, economisers and pumps, &c. The directors are: G. Clark, 6, The Green, Seaton Carew, Co. Durham (chairman and managing director); W. B. Marr, Glenville, Roker, Sunderland; and J. Snowball, 4, Viewforth Terrace, Sunderland. Secretary: J. Snowball. Registered office: Southwick Engine Works, Sunderland.

Anti Static Installation, Ltd.—Private company. Registered May 1st. Capital, £1,000. Objects: To carry on the business of manufacturers and distributors of and dealers in electrical and radio appliances, electrical and radio engineers, and installation consultants and contractors; to acquire (1) the business of Anti Static Radio installation carried on by H. S. Prince at 32, Furnival Mansions, Well Street, W.1, and other places, and (2) the business of the Telephone Installing Service Co., carried on by A. E. Allsop at St. Stephens House, Westminster. The joint managing directors are: H. S. Prince, 32, Furnival Mansions, Well Street, W.1 (chairman), and A. E. Allsop, 44, Riga Avenue, Winchmore Hill, N.21. Registered office: 10, St. Stephens House, Westminster, S.W.1.

Ramsden Patents, Ltd.—Private company. Registered May 1st. Capital, £1,000. Objects: To acquire the business of the "Rafaco Illuminations Company" carried on at 1, Banff Terrace, Wilmslow Road, Rusholme, Manchester; to adopt an agreement with L. A. Ramsden, H. Ford and J. Morgan; and to carry on the business of electricians, mechanical engineers, manufacturers and workers of and dealers in electricity and all classes of electrical equipment, motive power and light traffic control apparatus, &c. The permanent directors are: H. Ford, "Lightbounds," Uttoxeter, L. A. Ramsden, 1, Banff Terrace, Wilmslow Road, Rusholme, Manchester, and J. M. Redthorpe, Warwick Drive, Hale, Ches. H. Ford is the first chairman. Registered office: 56, Mosley Street, Manchester.

Air Conditioning & Engineering, Ltd.—Private company. Registered April 30th. Capital, £3,000. Objects: To carry on the business of engineers, founders, smiths, manufacturers of and dealers in machinery for cleansing and purifying air, &c. The directors are: V. A. Kraminsky, 4, Palmer Street, S.W.1; and W. F. Robins, 72, Fifth Cross Road, Twickenham. Registered office: 4/12, Palmer Street, S.W.1.

R. M. Clucas (Radio), Ltd.—Private company. Registered April 30th. Capital, £100. Objects: To carry on the business of manufacturers and repairers of and dealers in wireless and television receiving and transmitting apparatus, &c. The subscribers are: J. Sharp, 7, Birchtree Road, Aigburth, Liverpool, 17; and S. E. Allen, 3, Newell Road, Wallasey. Registered office: 20, Rathbone Street, Liverpool.

Ranburn Magneto Co., Ltd.—Private company. Registered April 27th. Capital, £100. Objects: To carry on the business of electrical and mechanical engineers, manufacturers and repairers of and dealers in dynamos, motors, magnetos, and batteries, &c. W. H. A. Wood, 8, Valleyfield Road, Streatham, S.W., is managing director and chairman for life. Solicitors: Crane & Hawkins, Bush House, Aldwych, W.C. 2.

Economic Water Heaters, Ltd.—Private company. Registered April 27th. Capital, £10,000. Objects: To adopt an agreement with T. R. Tusting and V. A. Stoneham, to acquire patents, licences and like rights and to carry on the business of manufacturers of, agents for and dealers in heating apparatus, geysers, radiators, boilers, stoves and other heating systems, whether electrical or otherwise. The subscribers are: R. C. Howley, 162, Manor Hall Road, Southwick, Sussex, and R. A. Pedder, 21, Knighton Road, Forest Gate, E.7. Solicitors: Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C.

Universal Radio Distributors, Ltd.—Private company. Registered April 29th. Capital, £100. Objects: To carry on the business of manufacturers of and dealers in gramophones and sound-reproducing machines, electricians, radio and electrical engineers, &c. The subscribers are: G. Mayle, 93, Kenthouse Road, Beckenham, Kent, and F. Graham Maw, Amberley House, Norfolk Street, W.C.2. Registered office: 24, Fitzroy Square, W.1.

Long & Co. Radio, Ltd.—Private company. Registered May 1st. Capital, £1,000. Objects: To carry on the business of electricians, radio and electrical engineers, &c. The permanent directors are: Mrs. N. E. Long and Miss E. N. Long, both of 44a, Surrey Road, Bournemouth. Registered office: 258, Old Christchurch Road, Bournemouth.

Returns of Electrical Companies

R. & W. Electrical, Ltd.—The nominal capital has been increased by the addition of £1,550 in £1 6 per cent. participating preference shares beyond the registered capital of £1,000.

Alton District Electricity Co., Ltd.—The nominal capital has been increased by the addition of £10,000 in £1 ordinary shares beyond the registered capital of £25,000. At March 26th, 1936, Associated Utilities, Ltd., held nearly all the issued shares.

Petersfield Electric Light & Power Co., Ltd.—The nominal capital has been increased by the addition of £20,000 beyond the registered capital of £20,000. The additional capital is divided into 16,500 ordinary and 3,500 preference shares of £1 each. At March 26th, 1936, Associated Utilities, Ltd., held nearly all the issued shares.

E. Powell, Ltd.—Satisfaction to the extent of £1,800 on April 9th, 1936, on mortgage dated December 30th, 1924, and registered January 18th, 1930.

Electric Cushions, Ltd.—Satisfaction in full on April 7th, 1936, of debenture dated September 3rd, 1935, and registered September 6th, 1935, securing £100.

Cheshire Cables, Ltd.—Particulars filed of £3,000 debentures, authorised April 3rd, 1936, charged on the company's undertaking and property, present and future, including uncalled capital (subject to a debenture), the amount of the present issue being £1,500.

Conradty Products, Ltd.—Particulars filed of £5,000 debentures authorised April 15th, 1936, charged on the company's undertaking and property, present and future, the amount of the present issue being £2,000.

Metropolitan Electric Supply Co., Ltd.—Particulars filed of debenture stock to secure £1,000,000 and premium up to 2 per cent. payable in certain events authorised by resolutions of January 14th, and February 3rd, 1936, and covered by trust deed dated April 7th, 1936, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued. Trustees Corporation, Ltd.

Freeborn Power Converters, Ltd.—Capital, £40,000 in £1 shares. Return dated January 11th, 1936. 30,000 shares taken up. £30,000 paid. Mortgages and charges, nil. A further 5,400 shares were allotted for cash on March 5th, 1936.

Edwards & Co. (Twickenham), Ltd.—Capital, £2,000 in £1 shares. Return dated December 6th, 1935. All shares taken up. £2,000 paid. Mortgages and charges, nil.

A. H. Cornwall, Ltd.—The nominal capital has been increased by the addition of £2,000 in £1 shares beyond the registered capital of £1,000.

Novodyne Products, Ltd.—Two notices of the appointment of A. C. Nash, incorporated accountant, of 5 and 7, St. Mary Axe, E.C., as receiver and manager on April 24th, 1936, under powers contained in 1st and 2nd debentures dated September 25th, 1935.

Bridgend Relay Service, Ltd.—Capital, £1,000 in £1 shares. Return dated September 23rd, 1935 (filed March 14th, 1936). All shares taken up. £1,000 paid. Mortgages and charges nil.

Halson Radio Co., Ltd.—Capital, £100 in £1 shares. Return dated December 31st, 1935 (filed February 28th, 1936). Fifty-two shares taken up. £52 paid. Mortgages and charges nil.

Alandale Radio & Television Co., Ltd.—Debenture dated March 24th, 1936, to secure £208, charged on the company's property, present and future, including uncalled capital. Holder: Mrs. L. King, 27, Little Heath, Charlton, S.E.

Radio Holdings, Ltd.—Capital, £10 in £1 shares. Return dated December 20th, 1935. Two shares taken up. £2 paid. Mortgages and charges, nil.

Kingsway Radio, Ltd.—Capital, £6,000 in 5,000 preference shares of £1 and 20,000 ordinary shares of 1s. Return dated December 17th, 1935. 3,500 preference and 19,202 ordinary shares taken up. £2,460 2s. paid on 2,400 preference and 1,202 ordinary shares, £2,000 considered as paid on 1,100 preference and 18,000 ordinary shares. Mortgages and charges, nil. A return of allotments, made up to February 28th, 1936, shows a further 1,400 preference and 700 ordinary shares allotted for cash.

Cambridge Instrument Co., Ltd.—The nominal capital has been increased by the addition of £45,000 in £1 ordinary shares beyond the registered capital of £195,000. Each preference and ordinary share of £5 have been subdivided into five shares of £1 each in their respective classes.

H. Norman Kirk, Ltd.—P. O. Williams, of Bank Chambers, Temple Street, Swansea, was appointed receiver and manager on April 28th, 1936, under powers contained in debenture dated November 20th, 1934.

Trowbridge Radio Relay Service, Ltd.—Capital, £4,000 in £1 shares. Return dated December 19th, 1935 (filed January 2nd, 1936). 2,001 shares taken up. £2,001 paid. Mortgages and charges, nil.

Heywood Relay Services, Ltd.—The nominal capital has been increased by the addition of £1,000 in £1 ordinary shares beyond the registered capital of £2,000.

Permaheat Safety Cushion Co., Ltd.—Issue on April 21st, 1936, of £50 debentures, part of a series already registered.

J. M. Fenn, Ltd.—M. J. Wilson, of 54/8, Wardour Street, W.1, ceased to act as receiver and/or manager on April 18th, 1936.

City Notes

W. T. Henley's Telegraph Works Co., Ltd., reports a profit for the nine months ended December 31st last of £237,576, as compared with £209,586 for three-quarters of the year to March 31st, 1935. The report points out, however, that the accounts include a full year's dividend in respect of certain investments, and they also include a full year's trading to December 31st of the overseas branches. After deducting directors' fees, debenture interest, &c., and adding £459,867 brought in, £9,147 transferred from reserve against trustee securities, and £25,000 transferred from provision for income tax no longer required, there is a total of £680,686 available. Premium on redemption of debenture stock requires £7,500, and provision for special depreciation and the obsolescence of buildings, plant and machinery £25,000. As announced in our last issue, the final ordinary dividend is 1s. 6d. per share, making 3s., plus a bonus of 1s. 6d. per share, all less tax. The distribution for the nine months amounts to 22½ per cent., or at the rate of 30 per cent. per annum, the same rate as paid in 1934-35. The balance carried forward is £492,936. The directors report that there has been a general improvement in business, and they consider the results shown are satisfactory. Meeting: May 15th.

The Southern Areas Electric Corporation, Ltd., in its report for the year ended December 31st last states that during the year the company acquired the whole of the shares of the Brentwood District Electric Co., Ltd., and the Brentwood District Electric Installations, Ltd., together with approximately 99 per cent. of the ordinary shares of Mawdsleys, Ltd. The net dividends receivable from all subsidiary companies for the year (after providing in their accounts £16,503 for depreciation) were £23,850 (against £9,788). From this is deducted net interest on bank loans (£9,094) and net expenses of the Corporation (£2,246), and after adding £2,416 brought in, there is a balance of £14,926. Contingency reserve receives £2,000, and the final dividend is 2½ per cent., making 4 per cent. for the year (same), leaving £2,692 to be carried forward. Since the board assumed the management of the subsidiary undertakings considerable economies have been made, the full result of which should be experienced in the current year.

The Calcutta Electric Supply Corporation, Ltd., reports a profit for 1935, after allowing for depreciation, of £472,515 (as against £490,775 for 1934) to which is added £35,690 brought in, making £508,205. From this is deducted debenture interest, &c., leaving a balance of £220,282. Reserve receives £50,000, the retiring gratuity fund £7,000, and a final ordinary dividend of 7 per cent. is recommended, making 12 per cent., tax free, for the year, while £36,961 is carried forward. During 1935 there was a marked increase in the industrial load and the loss of revenue due to the reduction in the domestic flat-rate was to a considerable extent made good by improved consumption. Sales totalled 262,913,080 kWh, as compared with 229,936,667 kWh for 1934, and the number of houses connected at December 31st last was 45,949, representing an increase of 2,648.

Babcock & Wilcox, Ltd.—Presiding at the annual meeting held on May 4th, Sir John Dewrance (chairman), said that the volume of orders so far during the current year was satisfactory. The directors had decided to reconstruct the steel foundry and to carry out certain works at Renfrew. The improvement in general conditions had continued so far as the home market was concerned, but a large portion of their business came from abroad, and world conditions were so unsettled and the restrictions and other difficulties in many countries such that they felt it necessary to recommend a conservative policy in the distribution of profits. They proposed, therefore, to place £100,000 of the profits for the year to the dividend equalisation fund, as they considered it necessary to continue the process of restoring that fund so that it might be available if required.

The County of London Electric Supply Co., Ltd.—The subscription list opened and closed on Tuesday last for the issue at par of £2,500,000 3¼ per cent. debenture stock, redeemable 1952-1972, at £100 per cent. The stock of the present issue is secured by a trust deed of May 19th, 1927, in favour of the Electric & General Investment Co., Ltd., and the Law Debenture Corporation, Ltd., as trustees, creating a floating charge (which is now a first floating charge) upon the whole of the company's undertaking, property and assets, present and future. The object of the issue is to repay a loan from the company's bankers, to provide funds for further general development and to finance development of subsidiary and associated undertakings. The issue was over-subscribed.

The Cawnpore Electric Supply Corporation, Ltd., reports a surplus for 1935, after allowing for debenture interest, of £91,933, as compared with £102,235 for 1934, the decrease being due to the considerable reductions in charges made during the past year. A sum of £40,000 is transferred to depreciation and renewals account; income tax account receives £6,000, and the debenture sinking fund £12,396. A final dividend of 7 per cent. is recommended, making 10 per cent. for the year (unchanged), leaving £4,440 to be carried forward, against £6,603 brought in.

Pye Radio, Ltd., announces a profit, subject to audit, of £90,548, an increase of £39,274 over 1934. A final dividend of 6 per cent. on the preferred ordinary shares is recommended, making 10 per cent. for the year (same), and the deferred shares receive 125 per cent. for the year (same), the balance forward being £52,561, against £71,372 for the previous year. The directors recommend increasing the capital by the creation of a further 400,000 deferred 1s. shares and propose to issue as a bonus one fully paid deferred share in respect of every ten deferred shares held.

The Calcutta Tramways Co., Ltd., reports a revenue for 1935 of £110,571 (against £102,796), including exchange adjustment, less tax, contribution to provident fund and gratuity funds and after transferring £70,000 to depreciation fund. The addition of £8,504 brought in makes £119,075 available. Debenture interest absorbs £28,250, and the final ordinary dividend is 5½ per cent., maintaining the distribution for the year at 9 per cent. The amount carried forward is £15,325. Meeting: May 12th.

The Oriental Telephone & Electric Co., Ltd., reports a net revenue for 1935, after allowing for depreciation, of £101,625, as against £97,434, for 1934. A final ordinary dividend of 8 per cent. is proposed, making 12 per cent., tax free, for the year (same); £15,000 is allocated to general reserve and £5,000 to contingencies reserve. The balance forward remains virtually unchanged at £51,570.

The St. Austell & District Electric Lighting & Power Co., Ltd., reports a profit of £8,066 for 1935, to which is added £4,548 brought in, making £12,614. It is proposed to pay a final ordinary dividend of 5 per cent., making 10 per cent., less tax, for the year, and to distribute a bonus to ordinary shareholders of one fully paid share for every five ordinary shares held, leaving £1,927 to be carried forward. The sales of electricity showed an increase of 46 per cent. as compared with 1934.

Companies to be Struck Off the Register.—The names of the following companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—Electrical Service & Supply Co., Ltd.; London Accumulator Service Co., Ltd.; Mawlite Electric Lamp Co., Ltd.; Paragon Electric Welding Co., Ltd.

The Telegraph Condenser Co. reports a net profit for 1935 of £51,642, as compared with £52,068 for the preceding year. The ordinary dividend for the year is maintained at 20 per cent., general reserve receives £5,000, and income tax reserve £5,000. The balance carried forward is £10,170 (against £10,011 brought in).

Tube Investments, Ltd., has announced an interim dividend of 5 per cent. on the ordinary stock and at the same rate relatively on the liaison ordinary shares. No interim payment was made last year but 10 per cent. and a capital bonus of 10 per cent. were distributed for the year.

The Bridgwater & District Electric Supply & Traction Co. reports a profit of £6,950 for 1935, as compared with £6,944 in the preceding year. The ordinary dividend for the year is maintained at 6 per cent., and £1,058 is carried forward.

Richard Johnson & Nephew, Ltd., propose to pay a dividend of 6 per cent. on the ordinary shares for the year ended March 31st last (against 4 per cent.).

Atlas Electric & General Trust, Ltd., has announced a final dividend on the 7 per cent. cumulative preference shares of 4 per cent. (less tax), making 7 per cent. for the year.

The Sphere Investment Trust announces a dividend for the year of 4 per cent. on the ordinary shares as compared with 3 per cent. for the previous year.

Stocks and Shares

TUESDAY EVENING.

POLITICAL and financial complications on the Continent, as well as in the United States, are held responsible for the uncertainty of tone that has developed in most of the markets round the Stock Exchange. Business has fallen off by reason of the diffidence which money feels, at the moment, of entering markets, even in the gilt-edged departments, although these latter, judged from experience, are likely to attract capital that puts safety before all other considerations at any time of general disturbance. The success of the Italians has had a repercussive effect in Paris, and the French elections of a few days ago, in which the extremists achieved an unexpected degree of success, brought about a revival of the talk that the franc is likely to be devalued. Such factors as these, while they have no direct bearing upon such stocks and shares as are included in our weekly price lists, do nevertheless exercise an influence over the mind of the investor, and of the speculator, too. The uppermost feeling just now is one of caution, with prospective buyers inclined to wait upon the course of events rather than to utilise money at their disposal. The natural tendency is for prices to yield a little ground.

Electricity Supply Shares

Lifeless conditions characterise the electricity supply market. Prices show few quotable alterations. Midland Corporations were quietly in demand and Hendons rose 6d. to 55s. Small shrinkages occurred in Clyde Valleys at 45s., and County of Londons, at 56s. 6d., the latter on news of the issue of £2½ millions debenture stock. The loan was offered at par and the interest is 3¼ per cent. West Gloucestershire ordinary stock put on another 2 points to 120.

Equally uninteresting are the shares of companies supplying electricity abroad. Palestine electrical issues continue dull by reason of the country's restless condition. Tokyo 6 per cent. bonds moved up to 86.

Cable and Wireless Stocks

The approach of the date for publication of the Cable and Wireless report is accompanied by a renewed quickening of activity in the stocks. Interest was whetted by the recent declaration that the past year's earnings were sufficient to allow the payment of a full year's dividend upon the 5½ per cent. preference capital. The arrears were thereby made good up to the end of March, 1934. Expectation looks for the report to outline some plan of reorganisation which will eliminate outstanding arrears and adjust the capital in such

a manner as to bring it into closer relationship with the altered earning capacity of the combine. Such a scheme would be of particular interest to holders of the "A" ordinary stock, who might find themselves in sight of a dividend sooner than they would under the existing arrangement. The "A" stock has been dealt in up to 29¾ during the week, but the price fell away to 28¾ on profit-taking. The preference stock also is below the best, but at 111 shows a gain of 1 on the week.

Globe Telegraph preference, at 14½, are a little reactionary. Oriental Telephones are lower despite the company's satisfactory report and accounts: Great Northerns and Marconi-Marines are both on the easy side. Canadian Marconis, at 8s. 3d., are firmer on the improved results shown in the report. Part of the capital is held by Cable and Wireless.

Transatlantic Stocks

A reaction in the prices of American and other Transatlantic stocks, coming, as it has done, after a lengthy period of sustained buoyancy, is not surprising. The severity of that reaction, however, spread consternation over a wide area. There would be little difficulty in finding an explanation for a dull tone in American stocks at the moment: in addition to apprehension of world-wide troubles, America has political difficulties of her own to bear. There is, also, a growth of the conviction that many business concerns are progressing not quite so fast as the prices of their stocks. A combination of these factors is quite sufficient to depress markets. No good reason has come to light to explain the abruptness of the break in prices. Neither is anyone prepared to say with conviction that the slump is only a temporary phase, or that the upward swing which followed may be expected to persist. On one point it can be said that there is a concurrence of views. That point is the assurance of ultimate successful recovery in American business, no matter what misfortunes or mistakes occur to hinder it, or how long it takes to mature.

Comparison of the current prices of a few Transatlantic electrical stocks, with those prevailing only three weeks ago, emphasises the extent of the slump. American "Tel. and Tel." were then standing at 167½; they are now no better than 152½—a decline of 15 points. Western Unions have fallen during the same period from 88 to 75½; International "Tel. and Tel." from 16¼ to 13, and Radio Corporations from 12⅞ to 10¼. Brazilian Tractions have declined from 12⅜ to 10½, Hydro Electrics from 8¼ to 6⅝, and International Holdings from 2 to 1 5/16.

Manufacturing and Equipment

The electrical equipment market has a slightly easier appearance. The outlook for the industry at home remains as good as ever, but the prospect is a little dimmed by the clouds hanging over Europe and America. An interesting item in last week's Naval supplementary estimates is the big increase in the provision for electrical apparatus. British Insulated rose superior to the prevailing trend by putting on ⅛ to 5⅜. Callenders are unchanged at 4½, but Henleys dropped to 7¼ and Telegraph Constructions lost 1/16 to 1 5/16. Declines of 1s. each occurred in Associated Electrical Industries and General Electrics. Telephone manufacturing shares are generally lower. In the latter group, Ericssons fell 1/16 to 2 3/16, and Telephone Manufacturing eased off to 9s. ex dividend. On the other hand, International Automatic ordinary improved to 46s. 6d., and the "B" deferred to 44s. 6d.

Chloride Electrical Storage, after touching £5 last week, came back to 97s. 6d. The dividend announcement is expected shortly. Enfield Rolling Mills shed 9d. to 23s. Babcock and Wilcox, at 51s. 3d., and Reyrolles, at 68s. 6d., are both easier, in spite of the news of substantial orders received by these two concerns in connection with the equipment of a new power station at Cape Town. The importance of securing contracts overseas was emphasised at the Babcock and Wilcox Company's annual meeting. The 5s. shares, newly introduced to the market, of Switchgear and Cowans, are being dealt in around 14s. 3d. Following upon the cut in electric lamp prices, Crompton Parkinsons showed fresh signs of weakness, but recovered later to 62s. 6d.

Miscellaneous Matters

The Parliamentary debate on the Ullswater report was construed as being unfavourable to the Broadcast Relay Service Company, whose shares relapsed in price from 9s. to 7s. in consequence. There is some weakness among new electrical issues. Losses ranging from a few pence up to a shilling are shown by Revo Electrics, 38s., J. & F. Stones, 8s., and Pressed Steels, 23s. 9d. Newman Industries are 3s. Max Stones are 3d. higher at 3s. 6d. in anticipation of a maiden interim dividend payment. International Combustions, after falling from 95s. to 94s., rallied to 95s. 9d.

A falling off of activity in Vactrics and British Vacuum Cleaners left the latter unchanged at 36s. 3d., and the former 9d. lower at 25s. 3d. Pye deferred rose to 16s. 6d. after publication of the excellent preliminary report, but subsequently were reduced to 15s. 6d. by a bout of profit-taking. Profits are well up, and shareholders are to receive a dividend of 125 per cent., as they did in the previous year, with the addition, this time, of a 10 per cent. share bonus. E. K. Coles firmed up to 28s., but Electric and Musical Industries fell away to 25s. 3d.

B.E.T. deferred and Tillings move uncertainly. The former are 25 points down at 1,600. Tillings fell from 71s. 9d. to 68s. 9d., rallying later to 71s.

Share List of Electrical Companies

Home Electricity Companies.

	Dividend. Nom.	Previous.	Last.	Price May 5.	Rise or Fall.	Yield p.c. £ s. d.
Bournemouth and Poole	1	15	15	77/6	—	3 17 5
City of London	1	7½	7½	37/6	—	4 0 0
Clyde Valley	1	7	8	45/-	−6d.	3 11 1
County of London	1	10½	10½	56/6	−6d.	3 14 4
Edmundson's 7% Pref.	1	7	7	36/-	—	3 17 9
Do. Ord.	1	7	8	45/-	—	3 11 1
Elec. Dis. Yorkshire	1	9	9	47/-	—	3 16 7
Elec. Fin. and Securities	1	12½	12½	3 3/8	—	3 12 9
Elec. Supply Corporation	1	11	11	64/6	—	3 8 2
Lancs Light and Power	1	7½	7½	39/-	—	3 17 0
Lond. Assoc. Electric	1	—	—	34/-	—	4 2 4
London Electric	1	7	8	40/-	—	4 0 0
London Power Deb. Red.	Stock	5	5	107½	—	4 13 0
Metropolitan	1	10	10	52/-	—	3 17 0
Midland Counties	1	7	7½	41/-	—	3 13 2
Mid. Elec. Power	1	8	8	42/-	+9d.	3 16 2
North Eastern Electric Ordinary	1	6	6	34/6	—	*3 9 7
Do. 7% Pref.	1	7	7	34/6	—	4 1 2
Northampton	1	10	10	53/9	−⅛	3 14 5
Notting Hill 6% Pref.	10	6	6	14½	—	4 2 9
North Met. Elec. Ordinary	1	10	10	3	—	3 6 8
Do. do. 6% Pref.	1	6	6	32/-	—	3 15 0
Scottish Power	1	8	8	43/3	—	3 14 0
South London	1	7	7	34/6	—	4 1 2
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	25/6	—	5 17 8
Yorkshire Elec.	1	8	8	46/-	—	3 9 7

Public Boards.

Central Electricity, 1950–70	Stock	5	5	118	+1⅛	4 4 9
Do. 1955–75	,,	5	5	120	+1	4 3 4
Do. 1951–73	,,	4½	4½	112	—	4 0 4
Do. 1963–93	,,	—	3½	102xd.	+½	3 8 8
London Elec. Trans. Gtd.	,,	—	2½	97	—	2 11 7
London & Home Counties, 1955–75	,,	4½	4½	113	+1	3 19 8
London Passenger Transport, A.	,,	—	4½	125½	—	3 11 9
Do. do. B.	,,	—	5	129	+½	3 17 6
Do. do. C.	,,	3½	4	104	—	3 17 0
West Midlands Joint Elec. 1948–68	,,	—	5	116½	—	4 5 10

Telegraph and Telephone.

American Tel. & Tel.	$100	9	9	152½	−10	5 18 0
Anglo-Am. Tel. Pref.	Stock	6	6	123½	—	4 17 2
Do. Def.	,,	1½	1½	29½	—	5 1 8
Cable & Wireless 5½% Pref.	,,	4½	5½	111	+1	4 19 1
Do. A. 7½% Ord.	,,	Nil	Nil	28⅝	−½	—
Do. B. Ord.	,,	Nil	Nil	8	—	—
Globe Tel. & Tel. Ord.	10	2½	3½*	16½	—	2 3 4
Do. do. Pref.	10	6	6	14½	−½	4 5 0
Great Northern Tel.	10	20	20	44	−1	4 11 0
Marconi-Marine	1	10	7½	32/6	−9d.	4 12 4
Oriental Telephone Ord.	1	12*	12*	3¼xd.	−1/-	3 16 10

Home and Foreign Trams, etc.

Anglo-Arg. Trams First Pref.	5	Nil	Nil	1/-	—	—
Do. do. 2nd Pref.	5	Nil	Nil	9d.	—	—
Do. do. 5% Deb	Stock	Nil	Nil	5	—	—
British Electric Traction Df. Ord.	,,	5	5	1600	−25	—
Do. do. Pref. Ord.	,,	8	8	181½	—	4 8 2
Brazil Traction	100	—	—	10½	−¾	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	102½	—	4 17 7
Mexican Light Common	100	Nil	Nil	3½	—	—
Do. 1st Bonds	$500	5	5	50	—	—
Victoria Falls Ord.	1	20	20	77/6	−6d.	—
West Riding	1	5	6½	52/6	—	2 9 6

Manufacturing Companies.

Aron Electricity Ord.	1	10	15	68/9	—	4 7 3
Assoc. Elec. Ord.	1	6	8	46/6	−1/-	3 8 10
Do. Pref.	1	8	8	39/-	—	4 2 1
Babcock & Wilcox	1	6	8	51/3	−⅛	3 2 5
British Aluminium Ord.	1	5	7½	40/-	−6d.	3 15 0
British Insulated Ord.	1	15	20	5⅜	+⅛	3 14 5
Brush Ord.	Stock	Nil	Nil	40½	—	—
Callender's	1	15	15	4½	—	3 6 8
Do. 6½% Pref.	1	6½	6½	32/6	—	4 0 0
Crompton Parkinson Ord.	5/-	—	12½	62/6	—	1 0 0
Do. 8% Pref.	1	8	8	2	—	4 0 0
Edison Swan 1st Pref.	1	7½	7½	30/-	—	5 0 0
Electric Construction	1	Nil	3½	1⅞	—	1 17 4
Enfield Cable Ord.	1	25	25	5⅜	—	4 13 0
English Electric	1	Nil	Nil	22/-	—	—
Do. do. Pref.	1	Nil	Nil	25/6	−6d.	—
Ericsson Tel.	5/-	24	20*	2⅛	−⅛	2 5 8
Ever Ready	5/-	35	35	25/6xd.	—	6 17 3
Ferranti Pref.	1	7	7	27/-	+6d.	5 3 8
G.E.C. Pref.	1	6½	6½	34/-	—	3 16 6
Do. Ord.	1	8	10	79/-	−1/-	2 10 8
Henleys	1	30	30	7½	−¼	4 2 9
Do. 4½% Pref.	5	4½	4½	5⅜	—	3 18 3
India-Rubber Preferred	1	—	5½	1½	—	4 17 9
Johnson & Phillips	1	7½	10	45/-	—	4 9 0
Lancashire Dynamo	1	5	10	2½	—	4 9 0
Siemens Ord.	1	6½	4	28/9	—	2 15 8
Telegraph Construction	£1	Nil	Nil	26/3	−⅛	

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1934

19403. "Coin-operated gas and electricity meters and like mechanisms." United Gas Industries, Ltd., E. W. Smith and A. Charles. June 30th, 1934. (445260.)

22908. "Magnetic recording and reproduction of sound." G. Bedeschi and G. Monti. July 18th, 1934. (445343.)

25320. "Luminous electric-discharge devices." General Electric Co., Ltd. (Patent Treuhand für elektrische Glühlampen.) September 3rd, 1934. (445187.)

25472. "Ceramic electric insulating material." W. Bloch. September 4th, 1934. (445269.)

25483. "Television." Dr. F. C. P. Henroteau. September 4th, 1934. (445413.)

25607. "Wireless and like receivers." E. S. V. Trufitt and R. E. Spencer. September 5th, 1934. (445273.)

25817. "Method of manufacturing bulbs for electric incandescent lamps." Jerome and Bonnefoy & Cie., and Lampe Yvel, Auto Lampe & Cie., Anciens Etablissement, L. Levy and A. Monnier. October 27th, 1933.

27906. "Blankets, pads, quilts, clothing fabrics, or the like, embodying electrical conductors." F. Grisley. September 29th, 1934. (445195.)

27957. "Electromagnetic field systems." H. Leitner. September 29th, 1934. (Cognate application 30300/34). (445347.)

28192. "Means for commutation in electric converting arrangements employing discharge devices." English Electric Co., Ltd. November 25th, 1933. (445418.)

28447/9. "Electron-discharge devices." Telefunken Ges. für Drahtlose Telegraphie. October 7th, 1933. (445285/7.)

28497. "Automatic tuning for radio receivers." E. K. Cole, Ltd., and G. Bradfield. October 5th, 1934. (445350.)

28783. "Electric-discharge devices." British Thomson-Houston Co., Ltd., H. R. Ruff and W. J. Scott. October 8th, 1934. (445427.)

28854. "Telemotor equipment, particularly for ship's steering gears." J. Bentley. October 9th, 1934. (445357.)

29094. "Method for synchronising the reception of television images." Radio Akt-Ges. D. S. Loewe. October 11th, 1933. (445428.)

29265. "Thermionic devices." Arcturus Radio Tube Co. October 12th, 1933. (445359.)

29271. "Magnets." W. Jessop & Sons, Ltd., and D. A. Oliver. October 12th, 1934. (445360.)

29741. "Modulated carrier-wave signalling systems." P. P. Eckersley. October 17th, 1934. (Cognate application 28711/35.) (445431.)

31569. "Electrodes for use in electric arc welding." Soudure Autogene Française. November 2nd, 1933. (445210.)

34410. "Cathode-ray tubes for television apparatus." A. B. Shorney. November 30th, 1934. (445372.)

36150. "Electric high pressure metal-vapour discharge lamps and like electric-discharge devices." General Electric Co., Ltd. (Patent Treuhand Ges. für Elektrische Glühlampen.) December 17th, 1934. (445215.)

36943. "Short-wave radio systems." G. W. White and Baird Television, Ltd. December 24th, 1934. (445313.)

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2564. "Electromagnetically driven air pumps of compressors." G. Szekely. February 26th, 1934. (445441.)

2672. "Galvanic cells." Pertrix Chemische Fabrik Akt.-Ges. January 7th, 1934. (445379.)

3376. "Motor and driving wheel arrangements for electrically driven vehicles." Zavody Tatra Akciová Spolecnost pro Stavbu Automobilu Azeleznienich Vozu. June 28th, 1934. (445542.)

4391. "Electric resistances bodies of semi-conducting materials." Patent Treuhand Ges. für electrische Glühlampen. February 12th, 1934. (Cognate application 4392/35.) (445486.)

4974. "Screens for cathode ray apparatus." F. S. Turner. February 15th, 1935. (445316.)

5804. "Lighting fittings." General Electric Co., Ltd., and E. L. B. Damant. February 22nd, 1935. (445388.)

9733. "Electric cooking apparatus." E. Kolouch. March 28th, 1935. (445392.)

13759. "Electromagnetic coils." R. Bosch Akt.-Ges. May 14th, 1934. (Cognate applications 13760/35 and 13761/35.) (445227.)

21896. "Magnetos." R. Bosch Akt.-Ges. September 18th, 1934. (445453.)

22233. "Construction of grids for use in electron-discharge devices." Telefunken Ges. für Drahlose Telegraphie. August 6th, 1934. (445402.)

22278-9. "Electro-therapeutic bath apparatus." Ges. für Elektro Therapie. August 7th, 1934. (44554-5.)

22442. "Electromagnetic relays." O. Hendler. June 17th, 1935. (445403.)

23003. "Electrolytic condensers." Dubilier Condenser Co. (1925), Ltd. December 21st, 1934. (445328.)

24580. "Electric hand vacuum cleaners." Siemens-Schuckertwerke Akt.-Ges. September 5th, 1934. (445404.)

26456. "Coverings for the sound openings of broadcast receiver and loud-speaker cabinets." Z. J. Janosi. February 26th, 1935. (445244.)

27609. "Electric ignition systems for internal combustion engines." R. Bosch Akt.-Ges. October 25th, 1934. (445458.)

30712. "Joints for electric cables." British Thomson-Houston Co., Ltd. November 6th, 1934. (445333.)

37250. "Apparatus for measuring or indicating the state of charge and discharge of an electric accumulator battery." Brittania Batteries, Ltd. November 26th, 1934. (Addition to 438407.) (445336.)

33110. "Liquid insulation reservoirs for electrical installations." General Cable Corporation. December 12th, 1934. (445256.)

35582. "Apparatus for the electrical precipitation of suspended particles from gaseous fluids." Lodge Cottrell, Ltd. (Siemens Lurgi Cottrell Electrofilter Ges. für Forschung und Patentverwetung.) December 23rd, 1935. (445258.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 29th.

Supelend. No. 564957. Class 13. Electrodes of ordinary metal for electric welding.—La Société La Soudure Electrique Autogene, Brussels, Belgium (British representative, M. E. J. Gheury de Bray, First Avenue House, High Holborn, London, W.C.1).

Ada. No. 566746. Class 13. Electric irons.—Domestic Bargains, Ltd., 10, New Oxford Street, London, W.C.1.

Tenby Pilot. No. 566918. Class 13. Electric switches (ordinary) and plugs therefor.—S. O. Bowker, Ltd., Tenby Works, Regent Row, Birmingham.

A Successful Year in Northern Ireland

BECAUSE there was no considerable extension of the main transmission system of the Electricity Board for Northern Ireland during 1935 it is possible, as it has not been hitherto, to appraise the results of the Board's sales policy from the authority's annual report which has just been issued. In the twelve months to December 31st last 23,333,000 kWh was sold at an average price of 1.63d. per kWh, whereas in the previous year the amount was 13,910,000 kWh at 1.84d., the increase in sales being 9,423,000, or 67 per cent. At the end of the year consumers numbered 26,212 (7,500, or 40 per cent. more than at the close of 1934).

An important factor making for the success of the Board's sales policy was the assistance afforded to domestic consumers by trained demonstrators who, by helping housewives to obtain the best results from their equipment, have done much to popularise their use. Moreover, exhibitions of the latest types of appliances were held throughout the Board's area of supply.

In the sphere of electric cooking outstanding progress has been made, the number hired at December 31st last being more than 5,000. To encourage electric cooking among small consumers a new slot-meter tariff was instituted. Under the Board's assisted wiring scheme 5,095 installations were effected during the year, making the total number since the scheme was inaugurated 10,860.

In the realm of power supplies an interesting feature was the marked progress in electric heating by means of thermostatically controlled tubular apparatus, electrode boilers and electrical thermal storage equipment. The latter method is exemplified in the heating of the large premises for the British Broadcasting Corporation at Lisburn. Another application which made substantial headway is electric sterilising for farms and dairies; Mr. Lendrick McMaster, secretary to the Board, expresses the opinion that there is promise of a wider application of electricity in this connection, with advantage to the farming community.

With regard to generation, transmission and distribution, while the Board continued to obtain its main supplies from the Harbour power station of the Belfast Corporation, a certain amount has also been derived from the station at Londonderry since October 1st last, following the completion of the main transmission line from Omagh to Londonderry. During the year the stations at Pomeroy (the undertaking was acquired last year) and Dromore (County Down) were closed down and at December 31st the Board was only generating at Enniskillen. Arrangements were made for the establishment of a central control station at Rosebank, near Belfast, and also for the introduction of the latest type of protective devices at vital junction points throughout the system.

With regard to finance, the revenue incomes during 1934 and 1935 were £107,525 (excluding hire charges of £5,281) and £170,614, respectively. Revenue expenditure amounted to £103,975 in 1935 (£66,313 in 1934), and the credit balance was £66,639 (£41,212). After taking account of interest and other charges there was a surplus of £9,939 against which is set a deficiency of £9,601 in 1934, leaving £338. At December 31st the total indebtedness of the Board to depositors was £1,542,000. The amount outstanding in respect of loans taken over on the acquisition of undertakings was further reduced by £6,721 to £49,611.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Abbey Hulton (STAFFORDSHIRE).—Cinema, Leek Road; Frederick G. Yorath.

Aberdeen.—Houses (86), Great Northern Road; architect, Housing Department. Cinema, Diamond Street, for the North of Scotland News Theatres, Ltd. Reconstruction of High school for girls (£115,000); city architect.

Barking.—Factory, River Road; Potter & Clarke, Ltd. Flats (44), Upney Lane (£25,590); borough engineer. Extensions to works, 28-30, Ripple Road; E. Glenny & Son, Ltd.

Barnsley.—Houses (40), Southgate and Grenville Place, for V. Dunk. Senior schools, Monk Bretton; director of education.

Barnstaple.—Houses (50); Harry Branch, builder, Bideford.

Battle (SUSSEX).—Cinema, electrical work, for the Picture House (Battle), Ltd., 49, St. James's Street, London, S.W.1; T. F. Ford, architect, 35, Finsbury Square, London, E.C.2.

Bedford.—Premises, old Palace Cinema site, for Prices Tailors, Ltd.

Birmingham.—Cinema, 47-49, Station Street, for J. Cohen, 72, Woodbourne Road, Edgbaston. Factory, Lifford Lane, King's Norton; C. Bryant & Son, builders, Whitmore Road. Three schools for E.C. Rebuilding of premises, High Street, for Frederick Lawrence, Ltd., Westbourne Grove, London, W.2; Bovis, Ltd., builders, 35, High Street, London, W.1.

Blyth.—Baths and public hall, Renwick Road; borough engineer.

Bournemouth.—Shops, flats and offices, St. Peter's Road; Meyrick estate trustees.

Bursiem.—Electrical warehouse and showroom, Longport Road; L. Wignall.

Chatham.—Cinema (electrical work) for the A.B.C. Co., owners of Regent Cinema, High Street; Donald Shave, manager.

Cockfosters.—Houses (26), Sussex Way; H. S. Couchman & Sons.

Coseley (STAFFORDSHIRE).—Houses (215) between Bradley's Lane and Fountain Lane, for Mr. Hipkins, the Paddock.

Cosham (HAMPSHIRE).—Church and hall (£25,000), Highbury estate; Frank Privett, Ltd., builders, Portsmouth.

Coulsdon.—Industrial premises, Brighton Road; Thomas Haywood & Sons.

Coventry.—Additions to the Coventry and Warwickshire Hospital (£11,850) with electrical work; First Section, W. H. Jones & Sons, builders.

Cranleigh (SURREY).—Cinema; Sir Eric Bonham.

Crewe.—Junior schools, Underwood Lane, for Borough E.C.; Biram & Fletcher, architects, St. Helens.

Darlington.—Additions to Public Assistance Institutions; borough engineer.

Dover.—Houses (36) and shops, Union Road; borough surveyor.

Droitwich.—Houses (400), Fernhill Heath, for Cadbury Bros., Bourneville, Birmingham; Estate Office, Bourneville.

Easington.—Houses (220), in connection with the slum clearance schemes; R.D.C. surveyor.

Eastbourne.—Houses, Peppercombe Road; Prospect Houses, Ltd.

Edgware.—Plaza Cinema between market and Holmstall Avenue, Burnt Oak; J. W. Green, architect, Bank Chambers, Stanmore.

Essex.—Senior schools, Loughton (£30,800) for County E.C.; J. Stuart, county architect, Chelmsford. Technical college (£169,007); F. R. Hipperson & Son, builders, Broad Street Place, London, E.C.2.

Glasgow.—Houses (250), Kelvindale and Carlisle Street; city architect. Church, Edgefaulds Road, for the Springburn United Free Church; Stellmacs, Ltd., 57, Oswald Street. Extensions to St. Thomas's R.C. school; Education director.

Haddington.—Houses (48), Amisfield Road; W. L. Hogg, burgh surveyor, 47, Market Street.

Halifax.—Houses (340), and bungalows, Park Lodge estate, flats, South Street, and houses, Pellon New Road, electrical work; D. T. Lloyd Jones, borough engineer.

Hampshire.—Police station and offices, London Road, Odiham; county architect, Winchester.

Hanley.—Factory, Clough Street, for Alcock, Lindley and Bloore, Ltd.; Adams & Edwards, architects.

Harlesden.—Cinema, for the Odeon Theatre, Ltd., 7, Park Lane, London, W.1.

Harrow.—Estate development, Pinner Wood Park; Artisans Dwellings Co., Ltd.

Hertfordshire.—Practical instruction centre, Cheshunt, for County E.C.; A. E. Prescott, county surveyor, Hatfield.

High Wycombe.—Houses (36); Charles H. Wright, architect, 24, Temple Street, Aylesbury.

Kent.—Central schools, Northfleet, for County E.C.; Ashford Builders Co., Ltd., Bloomsbury Square, London, W.C.2.

Kingston-on-Thames.—Houses (26) and flats, Dickerage Lane; borough surveyor.

Lancashire.—Branch library, Brook Road and Flixton Road, Flixton. Senior school, Failsworth, and reconstruction of Grammar school, Darwen, and Council school, Ormskirk, for County E.C.

Leek (STAFFORDSHIRE).—Houses (164), for Herbert Sleigh, Leek Silk Mills; Sharp & Cowburn, 40, South Kings Street, Manchester.

Lincolnshire.—Schools, Brigg (£20,820), and Waltham (£21,910); county director of education of Lindsey, Lincoln.

London.—(BERMONDSEY).—Flats and shops, Prospect Street (£72,550); Borough works manager. Extensions to factory, Drummond Street; Wallis Gilbert & Partners. (CHELSEA).—Shops and flats (eight storeys high), Sloane Street and Harriett Street; L. E. Ward, 19, Devereux Court, Strand, W.C.2. (LEWISHAM).—Factory, Worsley Bridge Road; Commercial Structures, Ltd., Staffa Road, E.17. (STOKE NEWINGTON).—Extensions to factory, Victoria Grove; A. W. Woolff & Co. (WESTMINSTER).—Flats (492); city engineer.

Maidstone.—Maternity block, West Kent Hospital (£14,888); secretary.

Manchester.—Flats (244), Miles Platting (£142,374); city architect. Extensions to Victoria University, Burlington Street, Chorlton; University trustees.

Middlesbrough.—Modernising the Holgate Hospital (£20,000); borough engineer. School, Fleetham Street; P. Haswell, education architect, Woodlands Road.

Middlesex.—Local county offices, High Street, Uxbridge (£28,000), and extensions to mental colony, Shenley; county architect.

Newcastle-on-Tyne.—Library, Brinkburn Street, for C.C.; city architect. Rebuilding of the Babies' Hospital and Mothercraft Centre for the governors of the Royal Victoria Infirmary (£37,000).

Newton-in-Makerfield (LANCASHIRE).—Houses (144); James Elston, architect, 18, Queen Street, Earlestown, Newton-le-Willows.

North Riding.—Schools, Catterick Camp, for County E.C.; F. Shepherd & Sons, builders, York.

Northumberland.—Alterations to Wooler Police Station and canteen, Morpeth Mental Hospital, for C.C.; county architect, County Hall, Newcastle-on-Tyne.

Nottingham.—Nurses' home, City Hospital (£37,677); Health Committee.

Plymouth.—Houses (88), Branckner Street; St. Aubyn Estates. Houses (112), Saltash Passage estate; G. Leverton. Reconstruction of High school and Stoke Demerel school; city architect.

Portsmouth.—Air port, Langstone Harbour (£100,000); Airport Committee.

Port Talbot (GLAMORGAN).—Central schools, Baglan estate; I. Morgan, director of education.

Richmond (SURREY).—Ritz Cinema (1,850 seats); Union Cinema Co., Ltd., 15, Lower Regent Street, London, W.1.

Ripon.—Premises, Market Square; Montague Burton, Ltd.

Sheffield.—Houses (44), Barholm Road; T. A. Knowles & Sons, Ltd. Houses (48), near Gleadless Road; E. Cooper. Houses (96), Lound Road; W. & E. Sadler, Ltd. Houses (32), Marsh Lane; T. V. & W. L. Simpson. Houses (22), Sandford Grove; C. W. Alflat. Houses (40), Swanbourne Road; M. J. Gleeson, Ltd. Canning factory, Limestone Cottage Lane; Batchelor & Co., Ltd. Celluloid factory, Union Lane; Lee & Crookes, Ltd. Factory and offices, Eyre Street and Brown Lane; Wm. Turner & Bros., Ltd. Works, Worksop Road; Brown Bayley's Steel Works, Ltd. Extensions to Lodge Moor Hospital (£20,500); city architect.

Smethwick.—Additions to works of Chance Bros. Co., Ltd., Oldbury Road, with electrical work.

South Ferriby (LINCOLNSHIRE).—Cement factory for Eastwoods, Ltd., 47, Belvedere Road, London, S.E.1.

Stafford.—Cinema, Newport Road (£30,000), with electrical work; C. Bryant & Son, builders, Whitmore Road, Small Heath, Birmingham.

Staffordshire.—Two senior schools, Lichfield; director of education, Stafford. Senior schools, Wordsley, electrical work (£16,958); director of education.

Stanmore.—Estate development, London Road; A. W. Curton, Ltd.

Stoke-on-Trent.—Houses (60), Station Road, Meir; H. Beckett, builder, Basford Road, Newcastle-under-Lyme. Factory, Campbell Road; Dart Fish Carrier Co., Ltd. Printing works, for James Heap (Hanley), 1925, Ltd., Bagnall Street, at the corner of Booth Street.

Stourbridge.—Houses (84), near High Park Avenue; A. & J. Mucklow.

Stratford-on-Avon.—Cinema, Bridge Foot, for the Stratford-on-Avon Picture House Co., Greenhill Street.

Stretford.—Factory for the Southern Oil Co., Ltd.

Tipton.—Houses (254), Moat Farm estate; Eadie & Co.

Tottenham.—Extensions to factory for Barber Wilson & Co., Ltd., Westbury Avenue, London, N.22.

Tranent.—Houses (144); burgh surveyor.

Wakefield.—Public baths, Sun Lane; Percy Morris, architect, Town Hall.

Waltham Abbey.—Houses (38); U.D.C. surveyor.

Wednesbury.—Houses (42), Dangerfield Lane; Arthur Booth, borough surveyor, Town Hall.

Welwyn Garden City.—Houses (366), and flats; Welwyn Garden City Co.; secretary.

Wembley.—Public offices, public hall, fire station, etc. (£160,000); U.D.C. surveyor.

Weston-super-Mare.—Block of business premises, Locking Road; N. H. N. Darby, architect.

West Riding.—School, Methley; director of education, Wakefield.

West Sussex.—School, Sidlesham; director of education, Chichester.

Whitehaven.—School, for Borough E.C.; education architect.

Wickford (ESSEX).—Cinema, High Street, for R. True.

Wigton (CUMBERLAND).—Houses (100), Highmore Croft; Stephen Mann, architect, Carlisle.

Worthing.—Block of cottage homes and administration quarters; A. T. W. Goldsmith, architect, 13, Liverpool Gardens.

York.—Houses (20), Holgate Hill estate; J. N. Dunn. Houses (156) and flats, Water Lane estate (£64,800); W. Birch & Sons, Ltd. Buildings for aerodrome; city engineer. Cinema, Clifton; Winder & Prendergast. School, Osbaldwick Lane, for E.C.